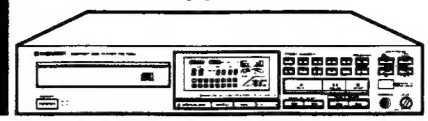
Service Manual



ORDER NO.
ARP1331

COMPACT DISC PLAYER

PD-7050
PD-7050-S

MODEL PD-7050 AND PD-7050-S COMES IN FIVE VERSION DISTINGUISHED AS FOLLOWS:

Type	Applicable model		Power requirement	Except destination
	PD-7050	PD-7050-S		
KU	O	–	AC120V only	U.S.A.
KC	O	–	AC120V only	Canada
HEM	O	O	AC220V, 240V (switchable) *	European continent
HB	O	–	AC220V, 240V (switchable) *	United Kingdom
SD	O	–	AC110V, 120-127V, 220V, 240V (switchable)	General market

* Change the position of jumper of the Transformer board assembly.

- **This service manual is applicable to the KU, KC, HEM, HB and SD types.**
- **As to the KC, HEM, HB and SD types, please refer to pages 76.**
- **Ce manuel d'instruction se refère au mode de réglage en français.**
- **Este manual de servicio trata del método ajuste escrito en español.**

CONTENTS

PIONEER ELECTRONIC CORPORATION 4-1, Meguro 1-Chome, Meguro-ku, Tokyo 153, Japan
PIONEER ELECTRONICS SERVICE INC. P.O. Box 1760, Long Beach, California 90801 U.S.A.
PIONEER ELECTRONICS OF CANADA, INC. 505 Cochrane Drive, Markham, Ontario L3R 6B8 Canada TEL: [416] 479-4411
PIONEER ELECTRONIC [EUROPE] N.V. Keetberglaan 1, 2740 Beveren, Belgium TEL: 03/775 - 28 - 08
PIONEER ELECTRONICS AUSTRALIA PTY. LTD. 178-184 Boundary Road, Braeside, Victoria 3195, Australia TEL: [03] 580-9911

1. SAFEY INFORMATION

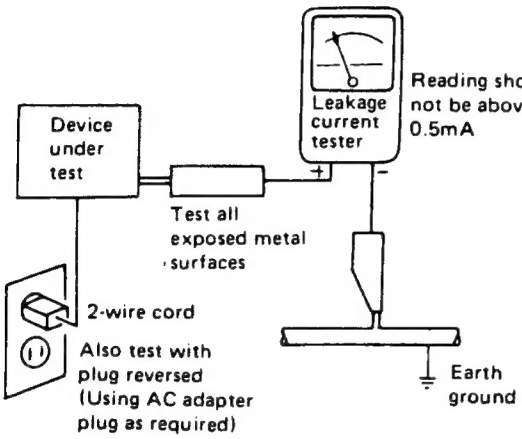
(FOR USA MODEL ONLY)

1. SAFETY PRECAUTIONS

The following check should be performed for the continued protection of the customer and service technician.

LEAKAGE CURRENT CHECK

Measure leakage current to a known earth ground (water pipe, conduit, etc.) by connecting a leakage current tester such as Simpson Model 229-2 or equivalent between the earth ground and all exposed metal parts of the appliance (input/output terminals, screwheads, metal overlays, control shaft, etc.). Plug the AC line cord of the appliance directly into a 120V AC 60Hz outlet and turn the AC power switch on. Any current measured must not exceed 0.5mA.



AC Leakage Test

ANY MEASUREMENTS NOT WITHIN THE LIMITS OUTLINED ABOVE ARE INDICATIVE OF A POTENTIAL SHOCK HAZARD AND MUST BE CORRECTED BEFORE RETURNING THE APPLIANCE TO THE CUSTOMER.

2. PRODUCT SAFETY NOTICE

Many electrical and mechanical parts in the appliance have special safety related characteristics. These are often not evident from visual inspection nor the protection afforded by them necessarily can be obtained by using replacement components rated for voltage, wattage, etc. Replacement parts which have these special safety characteristics are identified in this Service Manual.

Electrical components having such features are identified by marking with a ⚠ on the schematics and on the parts list in this Service Manual.

The use of a substitute replacement component which does not have the same safety characteristics as the PIONEER recommended replacement one, shown in the parts list in this Service Manual, may create shock, fire, or other hazards.

Product Safety is continuously under review and new instructions are issued from time to time. For the latest information, always consult the current PIONEER Service Manual. A subscription to, or additional copies of, PIONEER Service Manual may be obtained at a nominal charge from PIONEER.

(FOR EUROPEAN MODEL ONLY)

VAROITUS!
LAITE SISÄLTÄÄ LASERDIODIN, JOKA LÄHETTÄÄ NÄKYMÄTÖNTÄ, SILMILLE VAARALLISTA INFRAPUNASÄTEILYÄ LAITTEEN SISÄLLÄ ON LASERDIODIN LÄHEISYYDESSÄ KUVAN 1. MUKAINEN VAROITUSMERKKI.

LASER
Kuva 1
Lasersateilyn varoitusmerkki

WARNING!
DEVICE INCLUDES LASER DIODE WHICH EMITS INVISIBLE INFRARED RADIATION WHICH IS DANGEROUS TO EYES. THERE IS A WARNING SIGN ACCORDING TO PICTURE 1 INSIDE THE DEVICE CLOSE TO THE LASER DIODE.

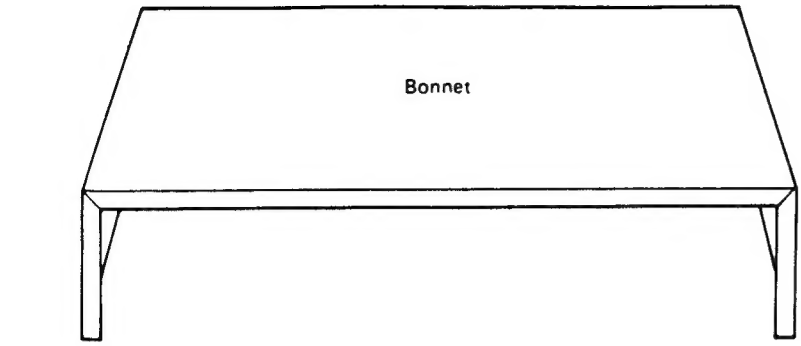
LASER
Picture 1
Warning sign for laser radiation

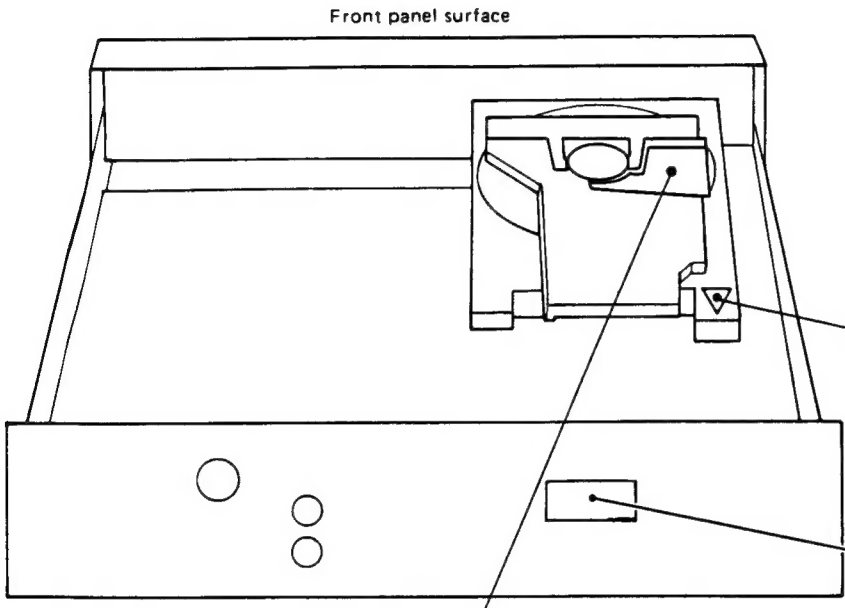
ADVERSEL:
USYNLIG LASERSTRÅLING VED ÅBNING NÅR SIKKERHEDSAFBRYDERE ER UDE AF FUNKTION UNDGÅ UDSAETTELSE FOR STRÅLING.

IMPORTANT
PIONEER COMPACT DISC PLAYER APPARATUS CONTAINS LASER OF HIGHER CLASS THAN 1. SERVICING OPERATION OF THE APPARATUS SHOULD BE DONE BY A SPECIALLY INSTRUCTED PERSON.

VIKTIGT
APARATEN INNEHÅLLER LASER AV HÖGRE KLASS ÄN 1. INGREPP I APPARATEN BÖR GÖRAS AV SPECIELLT UTBILDAD PERSONAL.

LABEL CHECK

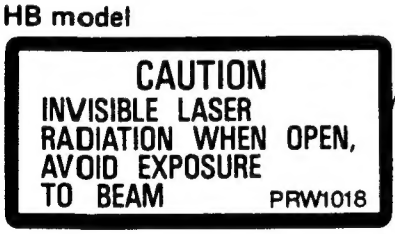




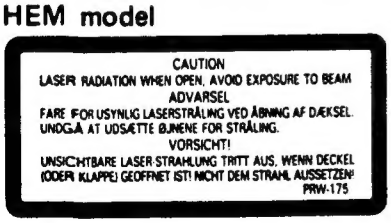
HEM and HB models

HEM and HB models

HB model



HEM model



ADDITIONAL LASER PRECAUTIONS

1. Laser Interlock Mechanism
   The clamp switch (S102) detects the completion of the Load in operation, and the ON/OFF status of the clamp switch is in turn detected by the microcomputer. The laser diode is designed not to oscillate while the clamp switch is in OFF status.
   Consequently, if S102 is accidentally short-circuited, the interlock mechanism will become incapable of operation.
   Moreover, when short-circuiting occurs between Pins 4 or 5 of CXA1081S (IC 1) and GND, or between Pin 29 of CXA1081S (IC 1) and GND, or between the terminals of Q1 (a Fault Condition will occur in all three cases), the laser diode will oscillate continuously.
   Note that during TEST Mode (see page 36), the interlock mechanism does not operate.
2. While the bonnet is in opened status, if the pickup is positioned to allow direct visibility of the objective lens at the outer periphery from the outer diameter of the disc clamper (80-mm diameter), the pickup can be flooded with radiation of more than class 1 of the laser optical system during any Fault Condition in Item 1 above or during TEST Mode.

2. SPECIFICATIONS

1. General

Type.....Compact disc digital audio system
Usable discs.....Compact Disc
Signal format.....Sampling frequency: 44.1 kHz
Quantized bit number: 16 bit linear
Power requirements
European models.....AC 220 V, 50/60 Hz
U.K., Australian models.....AC 240 V, 50/60 Hz
U.S., Canadian models.....AC 120 V, 60 Hz
Other models.....AC 110/120-127/220/240 V (switchable), 50/60 Hz
Power consumption.....15 W
Operating temperature.....+5°C - +35°C
Weight.....4.3 kg (9 lb, 8 oz)
External dimensions.....
420(W) x 315(D) x 84(H) mm
16-1/2(W) x 12-2/5(D) x 3-1/4(H) in

2. Audio section

Frequency response.....4 Hz - 20 kHz (±0.5 dB)
S/N.....104 dB or more (EIAJ)
Dynamic range.....95 dB or more (EIAJ)
Channel separation.....100 dB or more (EIAJ)
Total harmonic distortion.....0.0035% or less (EIAJ)
Output voltage.....2.0 V ± 0.5 V (EIAJ)
Wow and flutter.....Limit of measurement (± 0.001% W.PEAK) or less (EIAJ)
Number of channels.....2 channels (stereo)
Digital output.....0.5 Vp-p (75Ω)

3. Functions

- Play
- Pause
- Manual search
- Programmed playback
- Track search
- Index search
- Programmed repeat
- Pause program
- Direct track search
- All track repeat
- Add-on program
- Auto program editing
- Time fade editing
- Music window program
- Auto fade in/out
- OUTPUT level control
- Timer start

The above functions can be operated with the remote control unit.

4. Accessories

- Remote control unit.....1
- Size AAA/R03 dry batteries.....2
- Output cable.....1
- Operating instructions.....1

NOTE:
The specifications and design of this product are subject to change without notice, due to improvements.

3. PANEL FACILITIES

FRONT PANEL

Indicators

REPEAT : Lights during repeat play.

PROGRAM : Lights after programming (after program has been memorized).

TIME/REMAIN/TOTAL : Changes each time the TIME key is pressed.

- TIME : Displays the track number of the track being played, the index number *1, and the playback time (minutes and seconds).
- REMAIN : Indicates the time remaining on the track being played. When the TIME key is pressed again, the time remaining on the disc will be displayed.
- TOTAL : Displays the total number of tracks on one disc (TRACK) and the overall playback time (MIN, SEC).

During programmed playback operation, displays the remaining playback time of the programmed tracks (REMAIN), and the total playback time (TOTAL).

TRACK 1 — 15 and ➡ : Indicates current track number, and track numbers within program. The lower figures light up in accordance with the number of tracks recorded on the disc, and the numbers of the tracks which have been played extinguish in order. (During programmed playback only the programmed tracks light.) Above number 16 the ➡ mark lights.

MIN : Displays the playback time or remaining time in minutes.

SEC : Displays the playback time or remaining time in seconds.

MUSIC WINDOW IN : Lights when a Music Window has been programmed.

OUT : Lights when the Music Window program starts or during fade in.

LEVEL : Lights when the Music Window program ends or during fade out.

ATT : Displays the volume level during fade in and fade out, and when the volume control is adjusted.

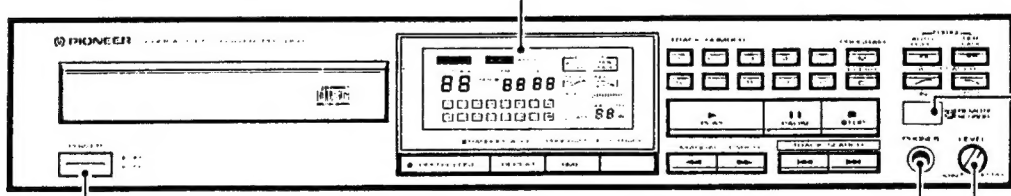
INDEX*1 : Displays the volume level decrease during fade in and fade out and volume control adjustment.

AUTO PGM EDITING : Displays index numbers which divide the music and tunes within one track. During programmed playback displays the step number.

TIME FADE EDITING : Displayed when Auto Program Editing is set or operated.

: Displayed when Time Fade Editing is set or operated.

*1The INDEX is a signal which is recorded within a track, to indicate division of the track into separate tunes and items of music.



POWER switch
Press to turn power to the unit ON and OFF.
If there is a disc in the unit when power is turned ON, playback will begin automatically. (Timer start function)

REMOTE SENSOR

PHONES (headphones) jack
When you wish to use headphones, insert the plug for the headphones into the headphone jack.

PHONES LEVEL control knob
Use to adjust the level of sound when using headphones. Turning the knob to the right increases the sound level.

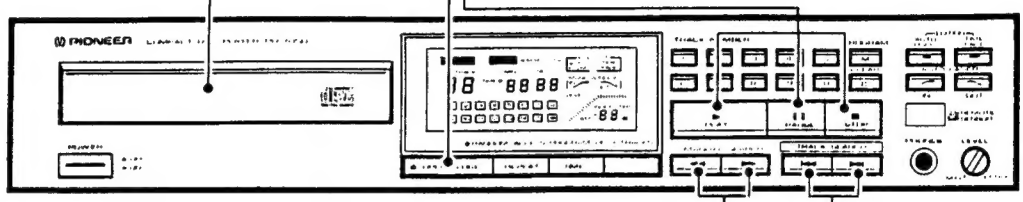
OPEN/CLOSE key
Press when you wish to eject or load a disc. Each time the key is pressed, the tray is alternately pushed out or pulled in.

Disc Tray
This is where the disc is set. When power is switched ON and the OPEN/CLOSE key is pressed, the tray is ejected forward.
To insert the tray, press the OPEN/CLOSE key, or lightly push the tray in with your finger. During play operation, pressing the PLAY key causes the tray to be inserted automatically.

STOP key
Press to stop playback. When pressed, the player goes into stop mode and all operations stop.

PAUSE key/Indicator
Press to temporarily interrupt playback. When pressed again, the pause mode is cancelled and playback resumes.

PLAY key/Indicator
Press to begin playback, and to cancel the pause mode.



MANUAL SEARCH Keys
When the player is in play or pause modes, these keys are pressed to perform fast forward or fast backward operations, to allow manual searching. These operations are only carried out during the time either key is pressed.

[►►] : Fast forward operation (If fast forward operation is performed to the end of the disc," End" will be displayed and the player will enter play mode.)

[◄◄] : Fast backward operation (If fast backward operation is performed to the beginning of the disc, the player will enter play mode.)

- For programmed playback, when the forward search reaches the next track, it will enter the pause mode. When it reaches the beginning of the track in backward search, the player will enter the playback mode.
- For Music Window playback, when the forward search reaches the starting point of window fade out, the player will enter the pause mode. When it reaches the starting point of the window in backward search, the player will enter the playback mode.

TRACK SEARCH keys
When the player is in the normal play, (or during programmed or Music Window playback) or pause modes, these keys are pressed to search for a desired track. Pressing either key causes the player to advance to the next track, or return to the previous track. The keys can also be used to check the contents of a program during program entry (but only when the player is stopped).

[►►|] : When pressed once, the disc playback advances to the beginning of the next track on the disc; when pressed continuously, the disc playback moves to the beginning of succeeding tracks on the disc. (During programmed playback, it moves to the beginning of the next programmed track.)
During Music Window playback, the player advances to the beginning of the next programmed window.

[|◄◄] : When pressed once, the disc playback returns to the beginning of the currently playing track; when pressed continuously, the disc playback moves further in reverse to the beginning of previous tracks on the disc. (During programmed playback it returns to the beginning of the previously programmed track.)
During Music Window playback, it returns to the beginning of the previously programmed window.

TIME key
- Use to select the method for displaying the playing time on the indicator panel.
  Each time the key is pressed, the indication changes from TIME, REMAIN, to TOTAL in that order. (For details concerning the display contents, refer to the explanation about the indicators.)
- If pressed after pressing the TRACK NO. key, the playback time of the selected track only is displayed.

REPEAT key
Press to perform repeat playback
- If pressed during normal playback mode, all tracks on the disc will be repeatedly played back.
- If pressed during programmed playback, the programmed tracks will be repeatedly played back in the programmed order.

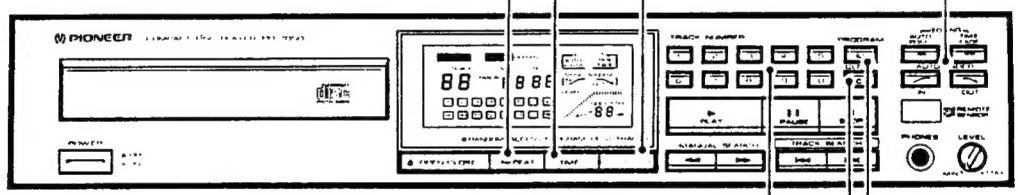
AUTO PGM EDITING key
Press to program a tune which may be played back within a specified time.

TIME FADE EDITING key
Press this key when ending play at a desired time with fade out.*1

DIGITAL FADE IN key (AUTO FADE IN)
When this key is pressed while in pause mode (during normal or programmed playback), the pause mode will be cancelled and playback will start with fade in sound*1.

DIGITAL FADE OUT key (AUTO FADE OUT)
When this key is pressed during normal or programmed playback, playback will PAUSE with sound fade out*1.

MUSIC WINDOW key (MUSIC WINDOW)
One Music Window step is designated by a starting point and end point stored in memory. Up to 8 Music Window steps can be programmed. During normal playback, each time this key is pressed, the start and end of the window can be designated alternately.



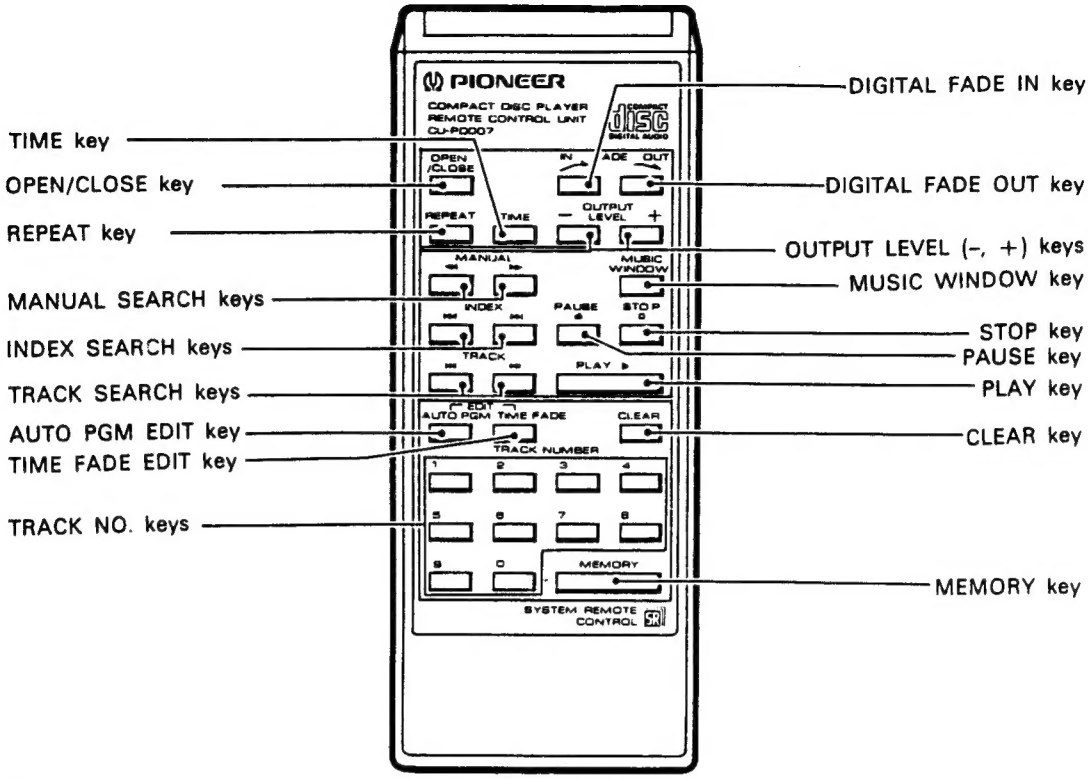
TRACK NO. keys (1 to 0)
- Use to specify track numbers (track 1 - track 99) for selection of tracks, program entry, or to confirm playback time.
- For Auto Program Edit or Time Fade Edit operation, the track number keys are used to specify the time period (in minutes).

PROGRAM key
Used to program a sequence of tracks:
- Press this key after selecting a desired track with the TRACK NO. keys. Tracks will be added to the program in the order in which a track is selected.

CLEAR key (CLEAR)
Press this key to clear the program or Music Window.

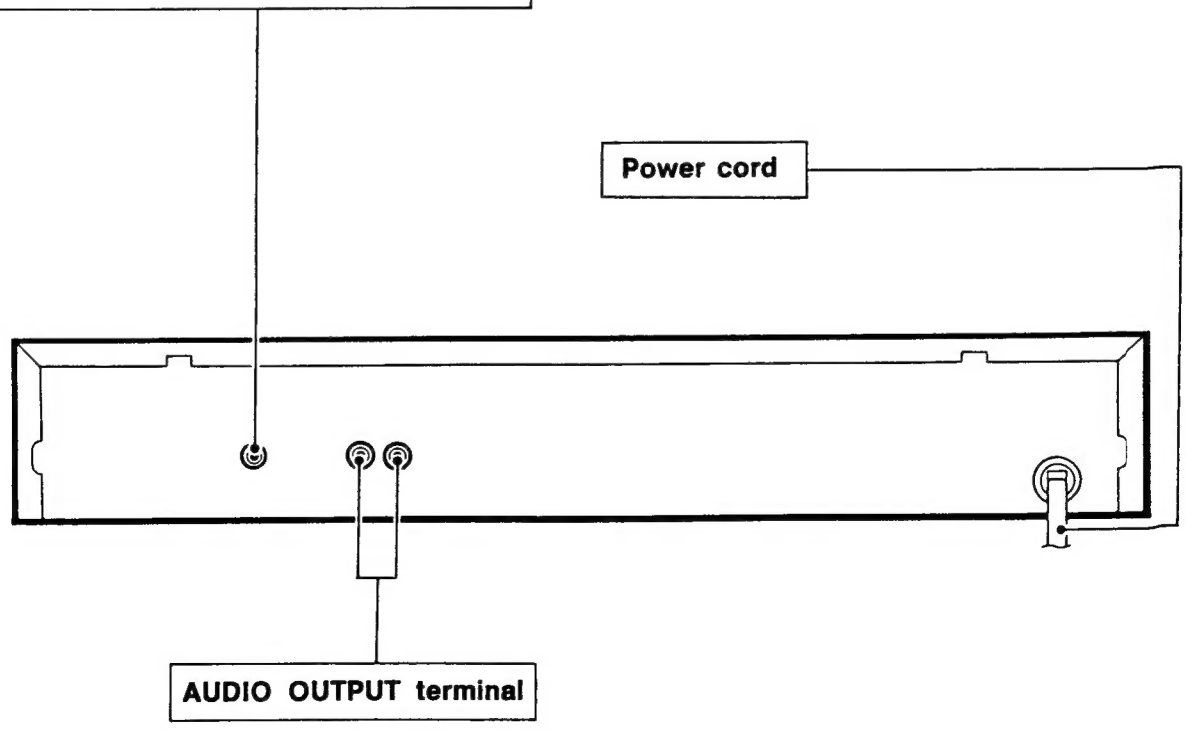
NOTE:
**1 The output level of the digital out output (digital data) cannot be controlled. (It will not fade in or fade out.)*

REMOTE CONTROL UNIT



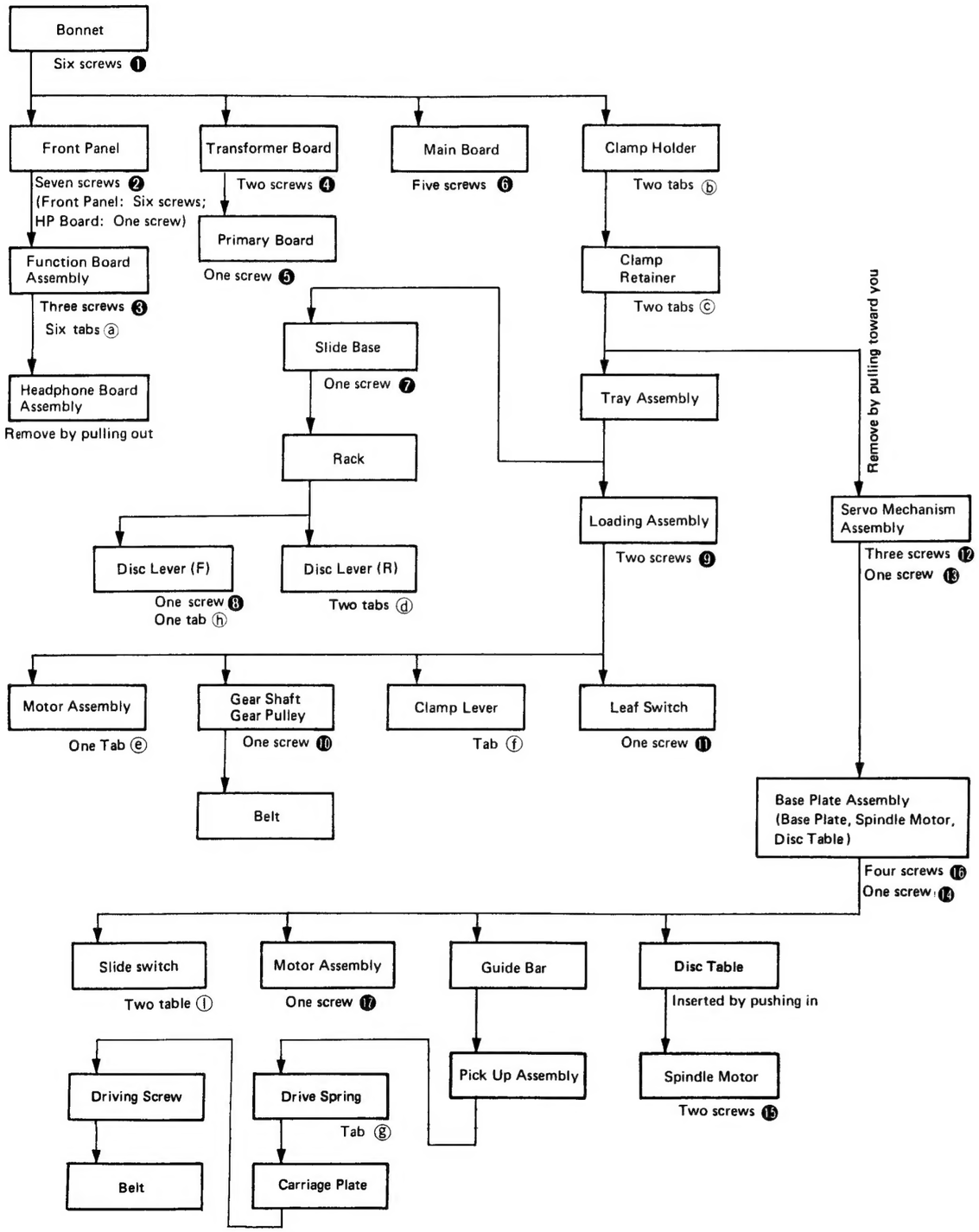
REAR PANEL

DIGITAL OUTPUT terminals (DIGITAL OUT)
The digital output terminals output the disc's audio data and sub-code data (certain data that can be recorded onto compact discs together with audio data) in their priginal digital from.



4. DISASSEMBLY

• FLOWCHART FOR DISASSEMBLY



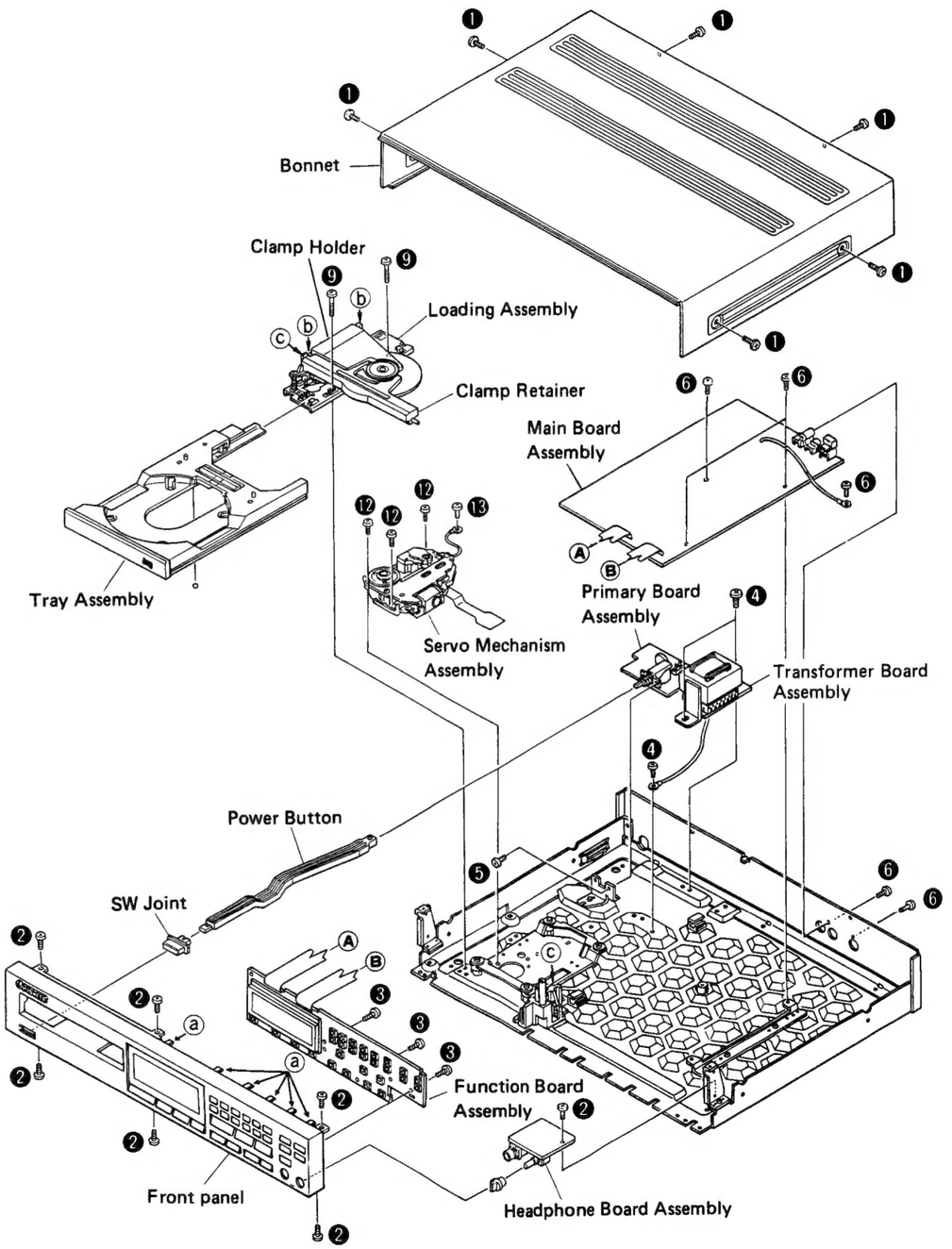


Fig. 4-1 Disassembly

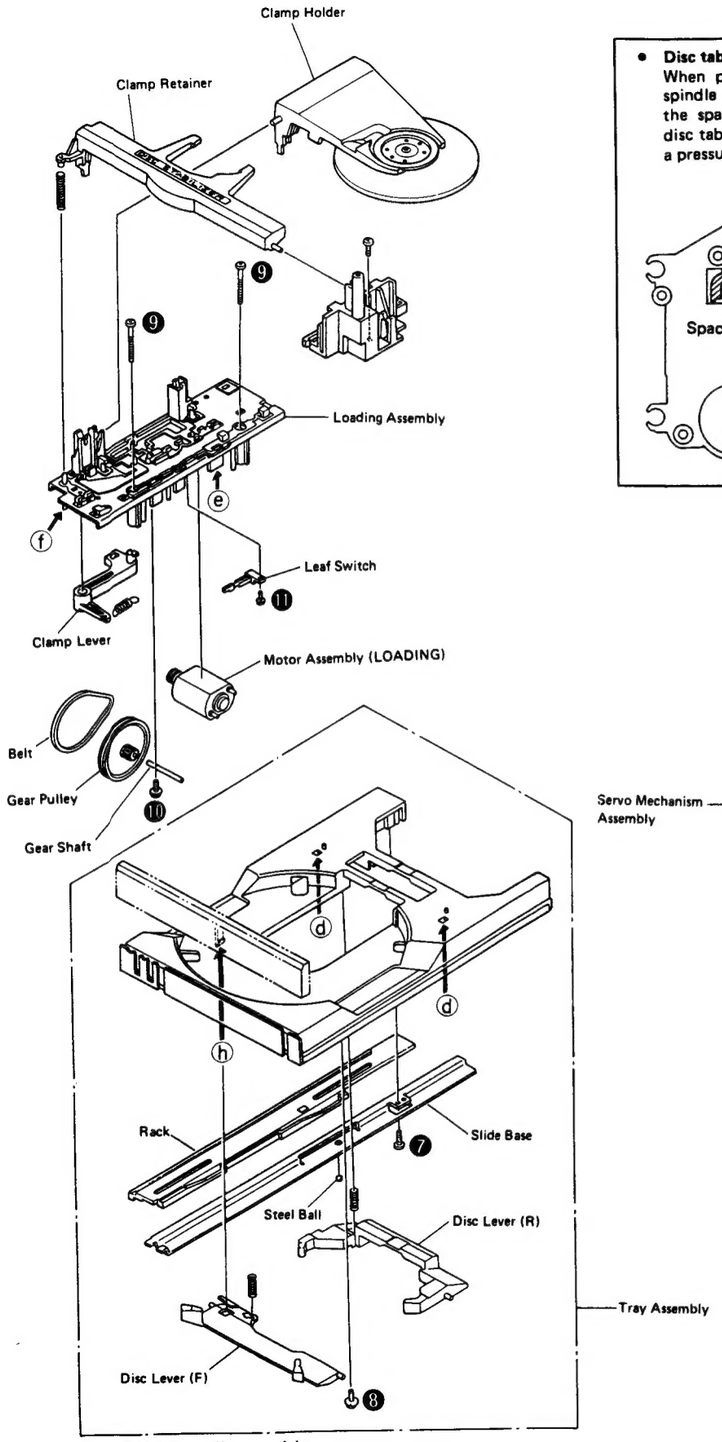


Fig. 4-2 Parts disassembly
(Loading mechanism and Tray assembly section)

- **Disc table installation**
  When press fitting the disc table, be sure the bottom of the spindle motor contacts the stopper. As shown in Fig. 4-4, insert the spacer (cut out from the mechanism chassis) between the disc table and the Base plate. Then press fit directly above. (With a pressure of about 9 kg.)

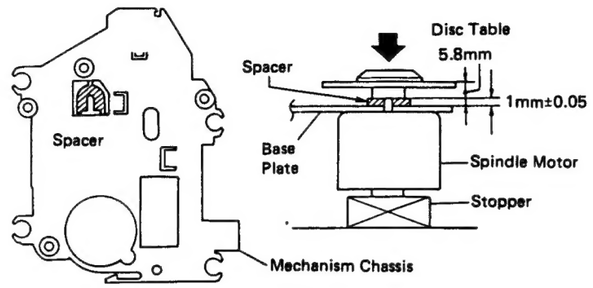


Fig. 4-4 Disc table installation

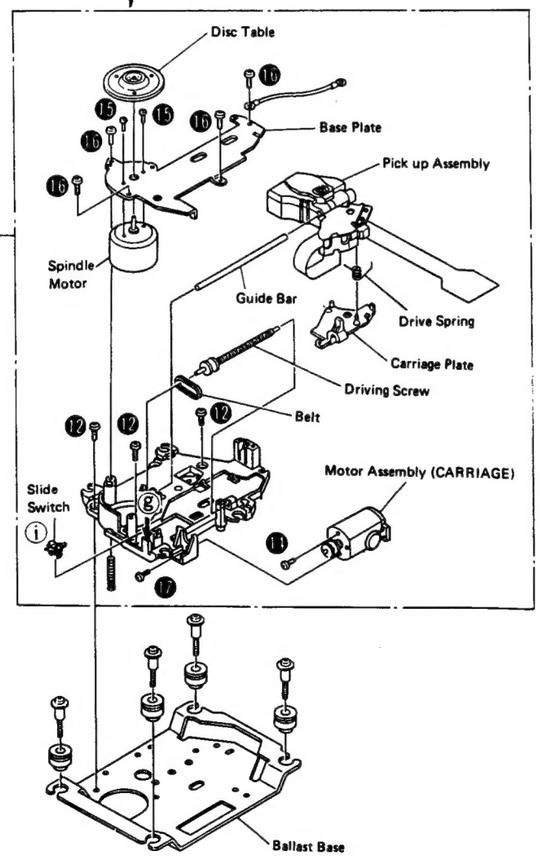
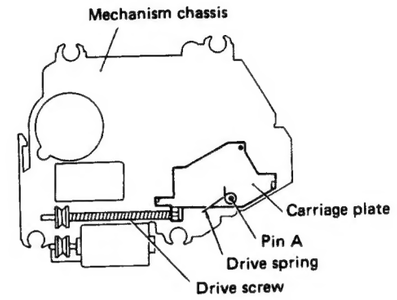


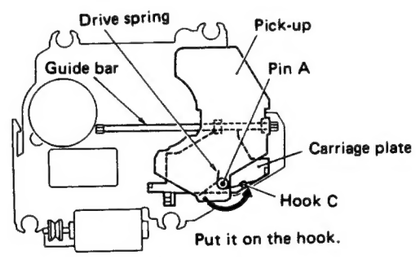
Fig. 4-3 Parts disassembly (Servo mechanism section)

Reassembly when replacing the Pick-up

1. Place the carriage plate on the outer-most periphery of the mechanism chassis.
2. Place the drive spring on pin A of the carriage plate. (As shown in the figure, have it rotate clockwise.)



3. After the guide bar is put through the Pick-up, align pin A of the carriage plate with hole B of the Pick-up. Place the guide bar on top of the mechanism chassis.
4. Next, mount the base plate. (4 screws on the base plate, 1 screw for the motor)
5. After mounting, put the drive spring on hook C of the carriage plate.



REMOVAL OF THE TRAY

- Removal of the disc tray

1. Press the rear edge of the rack, marked Ⓐ in Fig. 4-5 , while pulling the disc tray out to the position where it catches, illustrated in Fig. 4-6.
2. While pulling the clamp holder Ⓑ (see Fig. 4-6) upward with the right hand, hold the tray as indicated by Ⓒ in the left hand and pull it outward. Take care not to allow the ϕ4 steel ball to fall (we recommend holding the ball in place with the left index finger while extracting the tray).

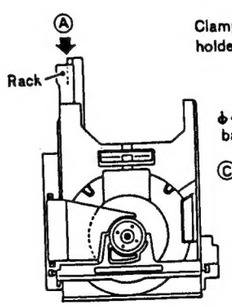


Fig. 4-5

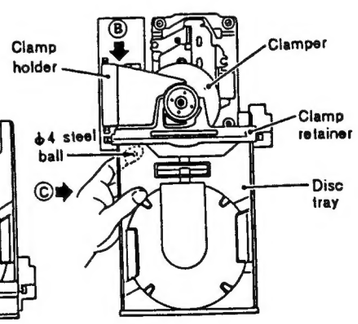
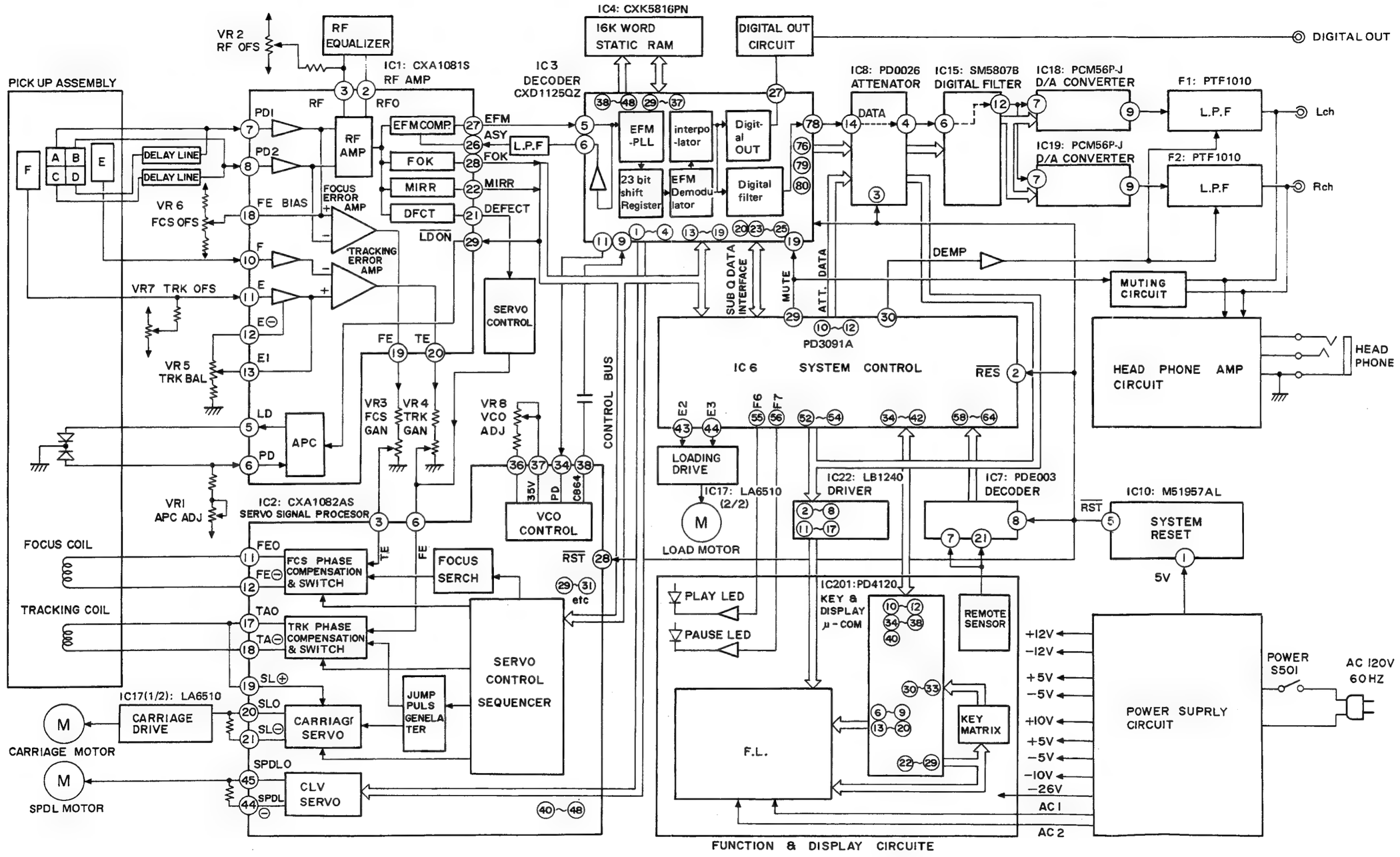


Fig. 4-6

3. BLOCK DIAGRAM

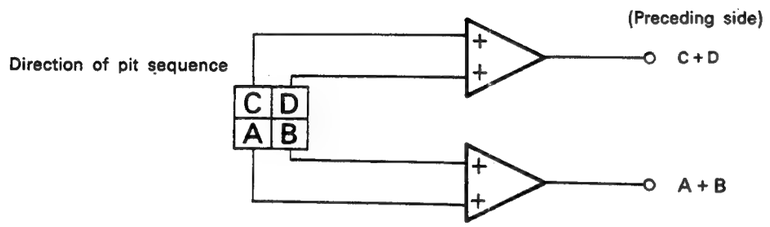
- For PD-7050



4. CIRCUIT DESCRIPTIONS

4.1 ACCURATE FOCUS SERVO SYSTEM

As a method (the Accurate Focus System) for reducing the distortion of RF signals read by the pickup, delays have been applied to the output of 2 photodiodes that precede the quarter photodiodes and is followed by an addition operation in order to achieve improvements in frequency responce, distortion, S/N, and so on as well as to increase the accuracy of signal reading.



(Former Method)

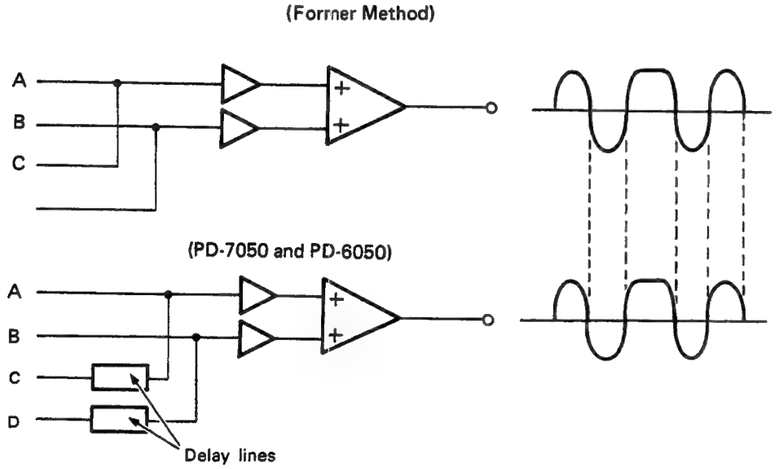


Fig. 4-1

4.2 IC DESCRIPTIONS

4.2.1 CXA1082AS

FOCUS SERVO SYSTEM

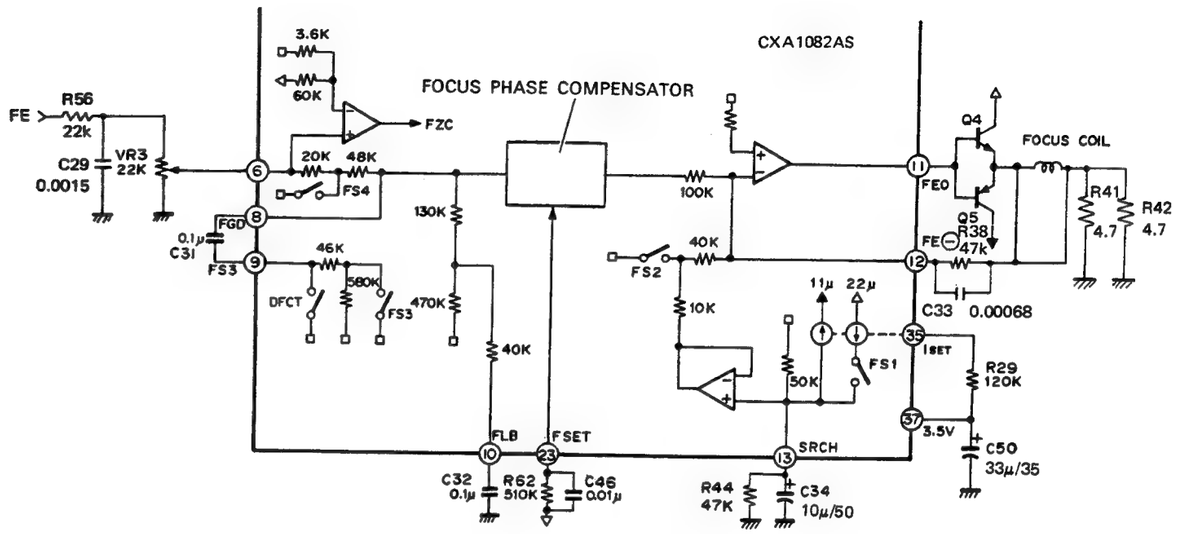


Fig. 4-2

The above figure is a block diagram of the Focus Servo System (Fig. 4-2).

When FS3 is ON, the high-cut filter gain that formed the low-range time constant can be dropped by the operation of the capacitor connected between Pins 8 and 9 as well as the internal resistor.

The capacitor between Pin 10 and GND is a time constant that boost the low-range frequency during normal play mode.

The peak frequency of the Focus Phase Compensator is in inverse proportion to the value of the resistor connected to Pin 23, and its peak value is approximately 1.2 kHz in case of 510kΩ resistance value.

The height of the focus search operation is approximately ±1.1 Vp-p in case of the time constants shown in the Fig. 4-2. This height is in inverse proportion to the value of the resistor connected between Pins 35 and 36.

This system is set to a value that is 5.7% of difference between the reference voltage Vcc for the inverted input of the FZC comparator and VC (Pin 1); that is, it is set to (Vcc - VC) × 5.7%.

NOTE:
When the value of the resistor connected to Pin 23 is changed, changes will also concurrently occur in the peak values of the phase-compensating peak value Focus Servo and Tracking and Carriage Servo systems as well as in the fc value of CVL LPF. In addition, the dynamic range and offset voltage of the OP Amp will also be concurrently changed.

TRACKING AND CARRIAGE SERVO SYSTEM

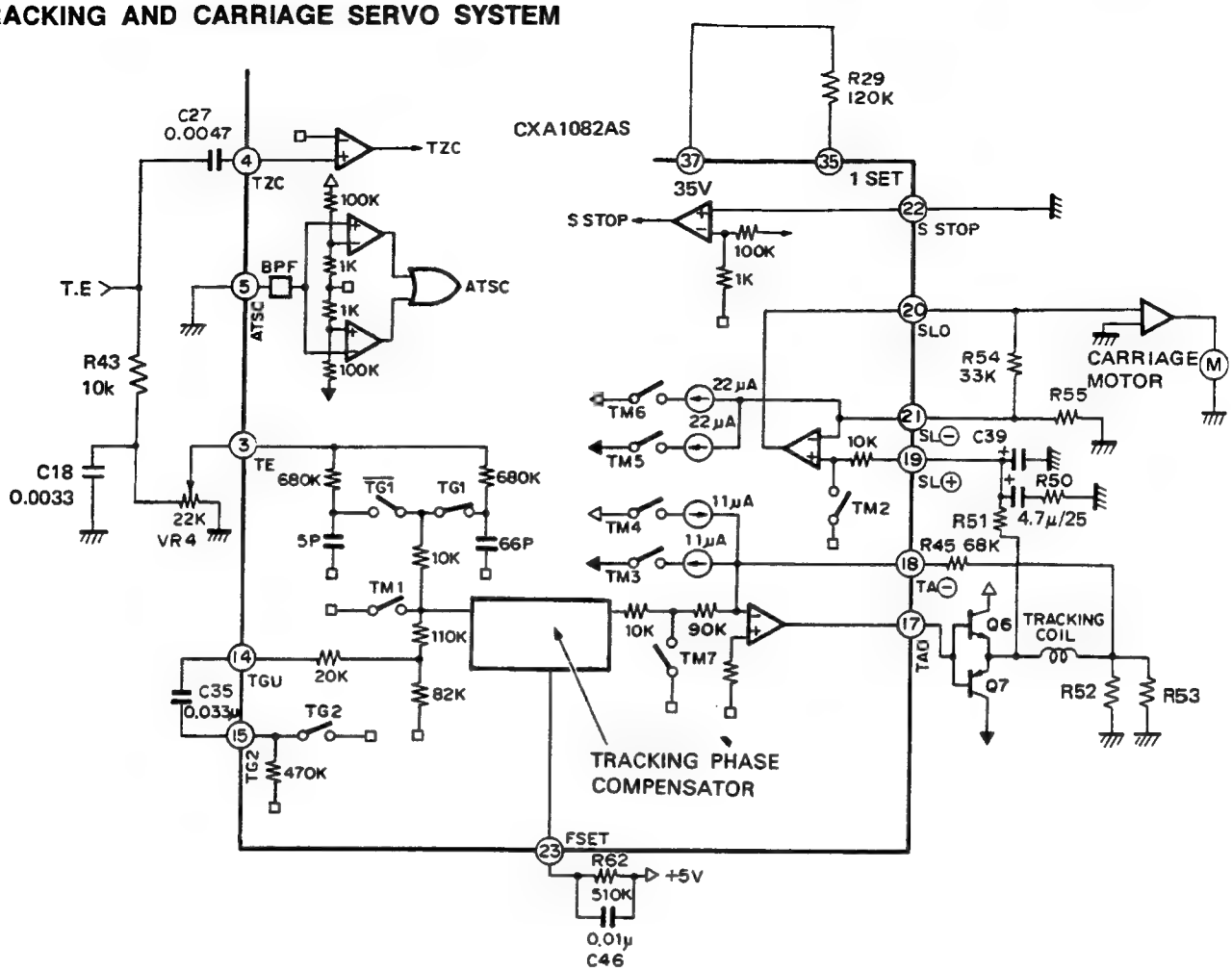


Fig. 4-3

The above figure is a block diagram of the Tracking and Carriage Servo System (Fig. 4-3).

The capacitor connected between Pins 14 and 15 is a time constant that functions to drop the high-range gain when TG2 is OFF. The peak frequency of the Tracking Phase Compensator is also in reverse proportion to the value of the resistor connected to Pin 23, and its peak value is approximately 1.2 kHz in case of 510kΩ resistance value.

TM3 or TM4 is switched ON in order to make a tracking jump in the FWD (forward) or REV (reverse) direction, respectively. The peak voltage to be applied to the tracking coil at this time is determined by the current value of TM3 or TM4 and the feedback resistor from Pin 18; that is:

Track Jump Peak Voltage =

TM3 (TM4) current value × feedback resistance value × $\frac{\text{TRK coil DCR}}{\text{R52//R53}}$

A FWD or REV carriage kick is performed by switching TM5 or TM6 to ON, respectively. The peak voltage to be applied to the carriage motor at this time is determined by the current value of TM5 or TM6 and the feedback resistor from Pin 21 ; that is:

Carriage Jump Peak Voltage =

TM5 (TM6) current value × feedback resistance value × $\frac{\text{R58}}{\text{R57}}$

The current value at each SW is determined by the value of the resistor connected to Pins 35 and 36. When its resistance value is 120kΩ, the respective current values will be as follows:

TM3, TM4 = ±11 μA TM5, TM6 = ±22 μA

SPINDLE SERVO, LPF

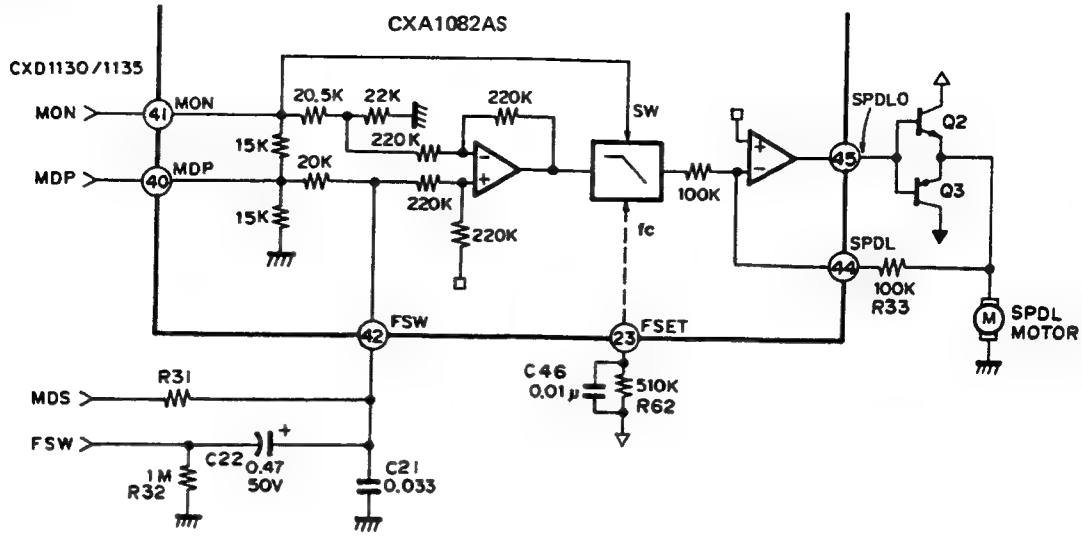


Fig. 4-4

A 200Hz LPF is formed at the 0.033 μF connected to Pin 42 and 20kΩ resistor and a secondary LPF is formed at the built-in LPF (Pin 23: fc - 200 Hz with a 510kΩ resistor), thereby eliminating the carrier components of the CLV Servo Error signals: MDS and MDP.
In CLV-S Mode, FSW goes low and the fc value of the Pin 42 LPF is lowered to further reinforce the filter.

VCO LOOP FILTER, 8.64MHz VCO

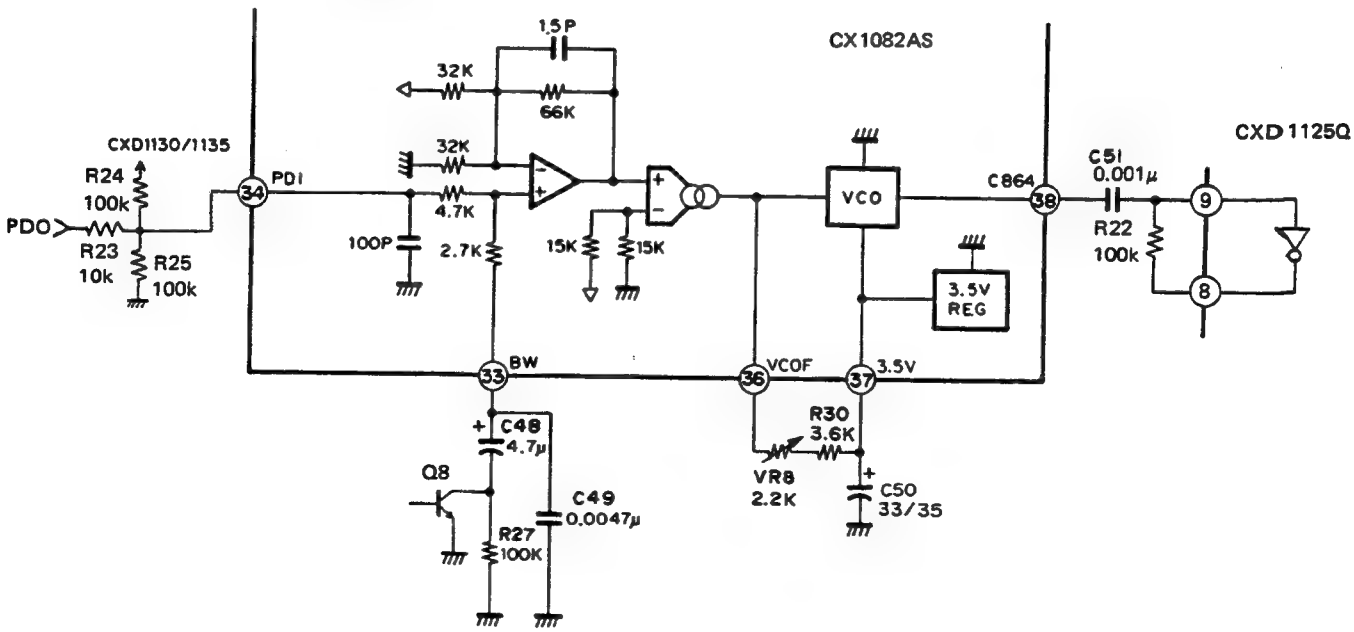


Fig. 4-5

The phase comparison output PDO which is input from Pin 34 subjected to V-I conversion after having its PWM carrier component eliminated at the Loop Filter. It is then added to the current from Pin 36 which is used for setting the free-run frequency in order to control the VCO frequency. The free-run frequency of the VCO is approximately in inverse proportion to the value of the resistor between Pins 36 and 37.

COMMAND

The input data used for operating this IC actually consists of eight bits. In the following description, however, each command will be expressed using a two-digit hexadecimal format of $XX (with X ranging from 0 to F).

1. $0X (㉔ SENS = "FZC")

This command is related to the control of the focus servo. Its bit configuration is as follows:

D7	D6	D5	D4	D3	D2	D1	D0
0	0	0	0	FS4	FS3	FS2	FS1

The four focus-related SWs are FS1 to FS4, which respectively correspond to D0 to D3 above.

$00 When FS1=0, Pin 13 is charged to: (22 μA - 11 μA) × 50 kΩ = 0.55V.
Moreover, if FS2=0, this voltage is transmitted no further and the ⑪ output becomes 0 V.

$02 In the above status, only FS2 becomes 1. At this time, a negative output is sent from Pin 11. This voltage level is stipulated as follows:
(22 μA - 11 μA) × 50 kΩ × Resistance value between ⑪, ⑫/50 kΩ .....Equation (1)

$03 In the above status, FS1=1 so that the +22 μA power supply is cut off.
Next, the Charge/Recharge circuit of CR is formed, and the voltage of Pin 13 drops with time as shown in Fig. 4-6 below.

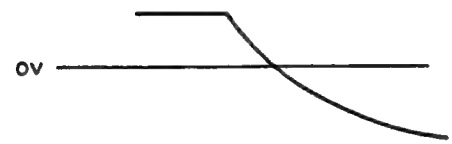


Fig. 4-6. Pin 13 Voltage when FS1 Changes from 0 to 1

This time constant is stipulated by C34 that is externally connected to 50kΩ.
The alternate issuing of $02 and $03 enables the creation of the search voltage for focus. (See Fig. 4-7)

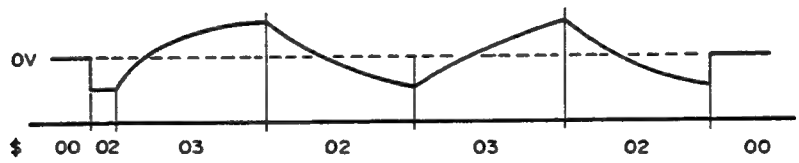


Fig. 4-7. Search Voltage Creation by $02 and $03 (Pin 11 Voltage)

1-1. Description of FS4

This switch is situated between Focus Error input 6 and the Focus Phase Compensator to receive the Focus Servo ON/OFF data.

$00 → $08
Focus OFF ← Focus ON

1-2. Procedure for Applying Focus

The following explanation will presume the below polarities:

(a) The lens is searching the disc in the far-to-close direction.
(b) At this time, the output voltage ⑪ changes from negative to positive.
(c) Furthermore, the S-curve of the focus at this time changes according to Fig. 4-8 below.

The Focus Servo is applied with Point Ⓐ of Fig. 4-8 as its operating point. The Focus Search operation is performed and the Focus Servo SW is set to ON while Point Ⓐ of Fig. 4-8 is being crossed. In order to also prevent malfunction, the logical product of the operation and the Focus OK signal is obtained.

This IC is designed so that FZC (Focus Zero Cross) will be output - as the signal which indicates the crossing of Point Ⓐ - from the ㉔ SENS pin. In addition, the Focus OK signal is output as an indication that focus is being applied (or can be applied in this case).

To summarize the above, the focus will be optimally applied in accordance with the time chart below. (In actuality, this IC's auto sequence is being used so the system μ-COM only sends $47 from point Ⓑ. See auto sequence on page 20.)

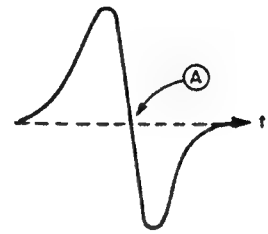


Fig. 4-8 S-Curve of the Focus

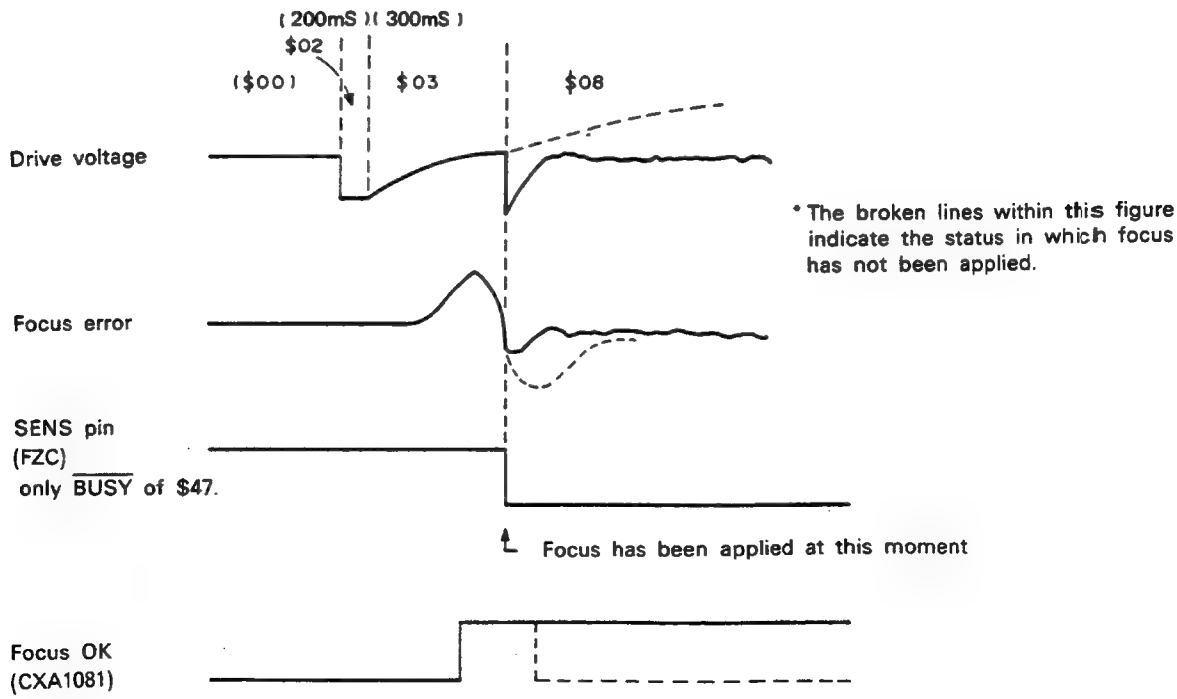


Fig. 4-9. Timing Chart of the Focus ON Operation

1-3.The ㉔ SENS Pin

The data which is output by the SENS pin will vary according to the input data as follows.
Since FOCS IN and TRACK JUMP are actually done by auto sequencing, the output of CXA1082AS, which uses system μ-COM, is only BUSY of $4X. (See auto sequence on page 20.)

$0X input → FZC output
$1X input → AS
$2X input → TZC
$3X input → SSTOP
$4X input → $\overline{\text{BUSY}}$
$5X-$7X input → HIGH-Z

Since any data above $7X is a command code of CXD1135, its connection with the "SENS" pin of CXD1135 will permit the output of various types from a single pin.

2. $1X (㉔ SENS = "AS")

This command is related to the ON/OFF status of TG1, TG2 and the Break circuit. Its bit configuration is as follows:

D7	D6	D5	D4	D3	D2	D1	D0
0	0	0	1	ANTI SHOCK ON/OFF	Break circuit ON/OFF	TG2	TG1

Brake circuit description

These switches are used to switch the Up/Normal status of the Tracking Servo gain. Because the Servo circuit exceeds the linear range after performing a 100- or 10-track jump, the settling of the actuator becomes extremely bad such that it will, for example, return after jumping only ten tracks, although a 100-track jump was intended, and such phenomena will frequently occur. It is the Break circuit, however, that functions prevent such occurrences. By exploiting the 180° phase offset between the RF envelope and the tracking error due to the direction of the actuator transversing the tracks along the radius from the inner to outer tracks and its reverse direction, the Break circuit cuts out the unnecessary portion of the tracking error and applies a break.

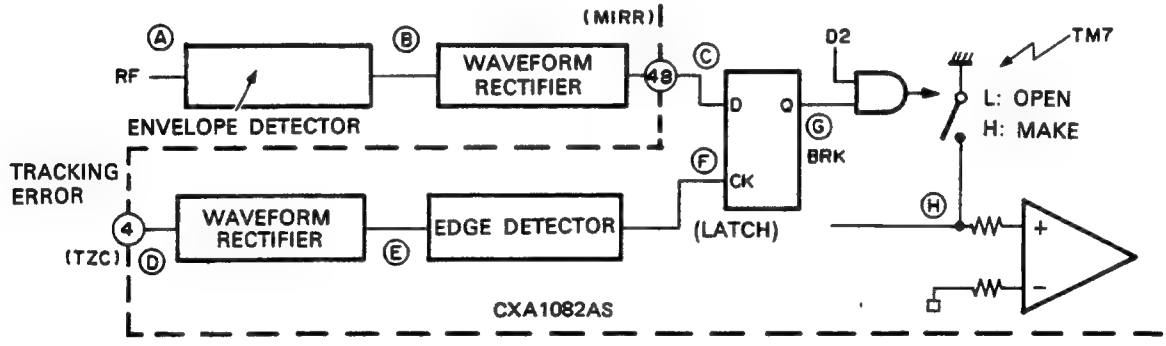


Fig. 4-10. TM7 Operation (Break Circuit)

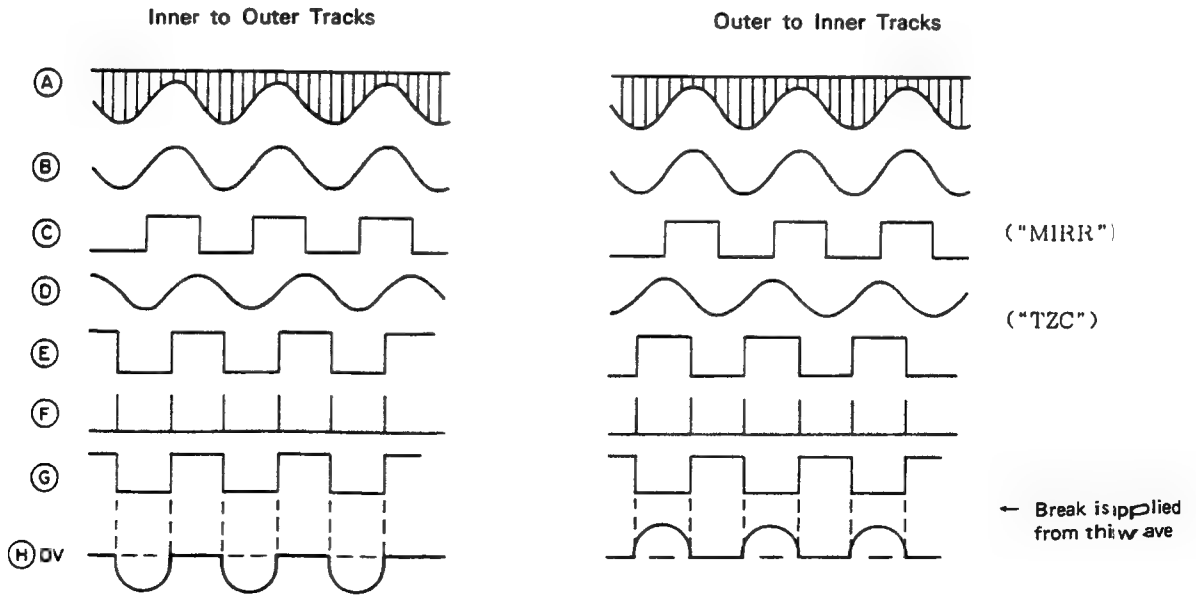


Fig. 4-11. External Waveforms

3. Track Jump

This CD player is doing track jumps of 1, 10, 50, 100 via the auto sequence of CXA1082AS. The auto sequence sends the timing data from the system μ-COM to the RAM of CXA1082AS beforehand. Therefore just by sending the serial data of the auto sequence, the TRACK JUMP and FOCS are drawn in.

Figures a. to d. show the timing charts of the 1, 10, 50, or 100 track jump and auto sequence. The time control in the figures is done by setting \$5X with the system μ-COM.

Auto sequence starts by the sending of \$4X in the table below.

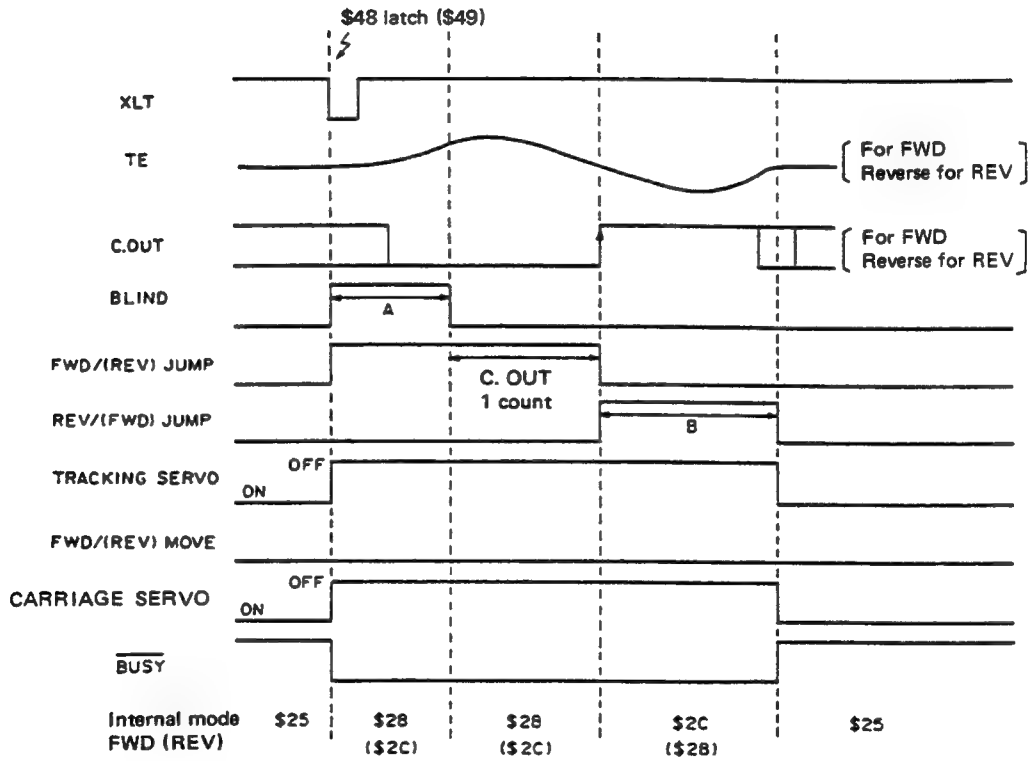
	D3	D2	D1	D0
CANCEL	0	0	0	0
FOCUS ON	0	1	1	1
1 TRACK JAMP	1	0	0	X
10 TRACK JAMP	1	0	1	X
100 or 50 TRACK JAMP	1	1	0	X

X = 0 FOWARD

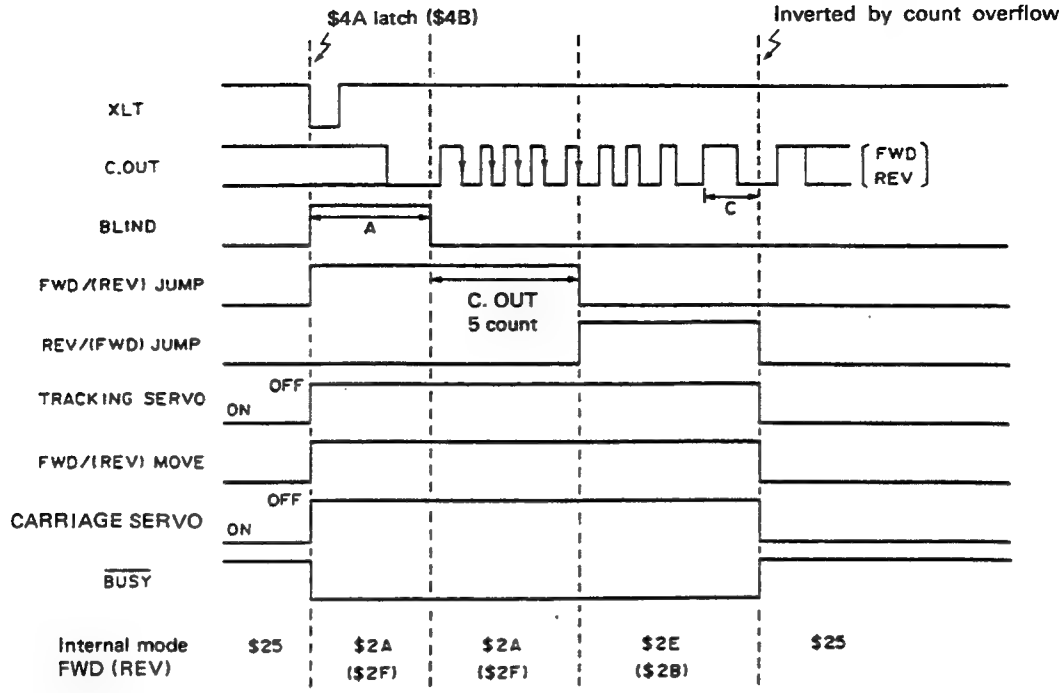
X = 1 REVERSE

Auto Sequence Time Chart

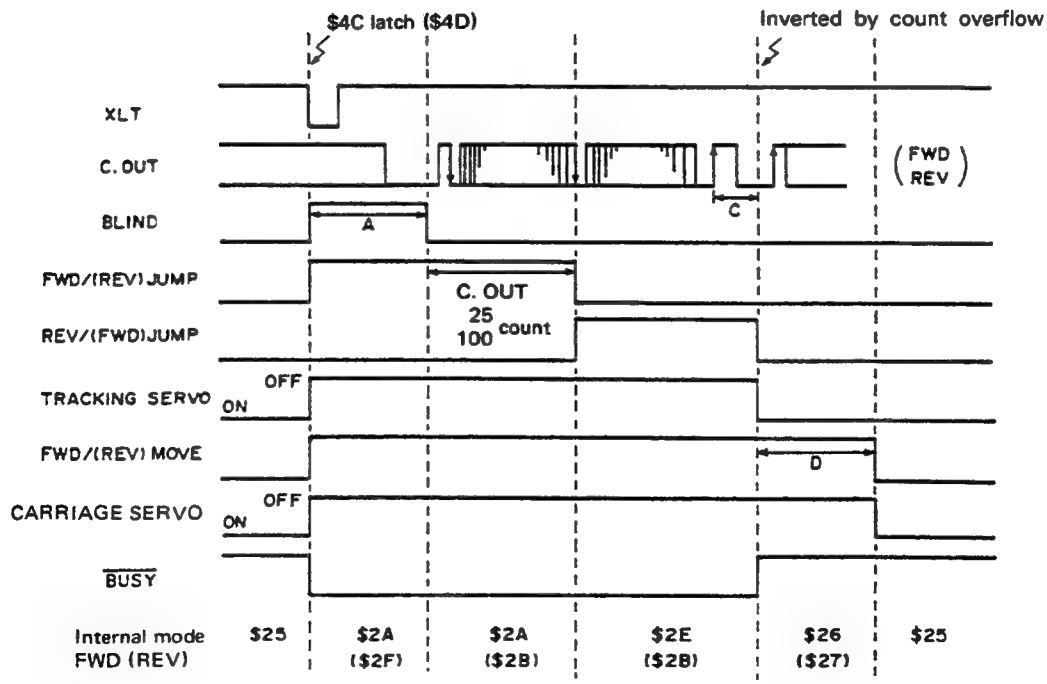
a. 1 track jump



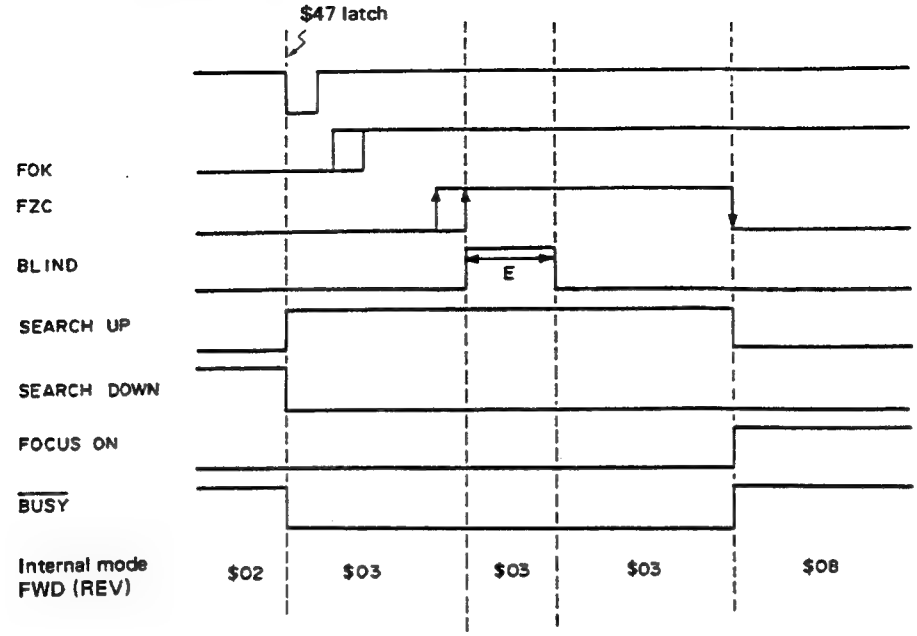
b. 10 track jump



c. 50 track jump
100



d. Auto focus



Note: This time chart's horizontal axis is not limited to being proportional to real time.

4.2.2 CXA1081S

RF AMP

The output voltage of the photodiode that are input to the input pins (PD1 and PD2) are respectively subjected to an increase in voltage of about 5 times into a 58kΩ equivalent resistor at the RF I-V Amps (1) and (2). Furthermore, addition is performed at the RF Summing Amp so that the output voltage which has been converted from the currents of the photodiodes (A + B + C + D) is output from Terminal RFO. An eye pattern check can be performed at Terminal RFO.

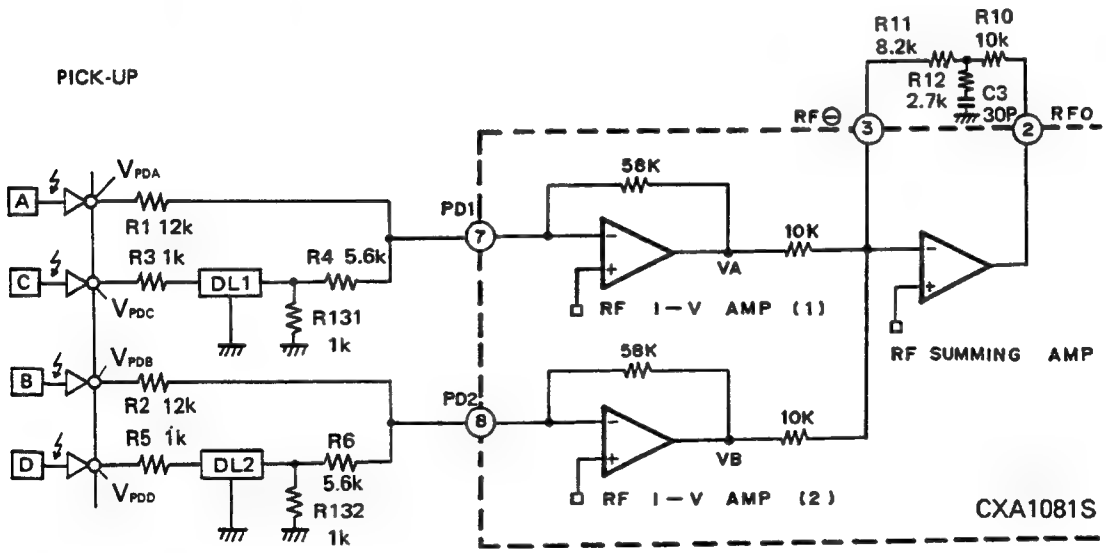


Fig. 4-12

The low-frequency component of the RFO output voltage V_{RFO} is as follows:

$$V_{RFO} = 1.8 \times (VA + VB)$$
$$= 1.8 \times (58k\Omega/12k\Omega) \times (V_{PDA} + V_{PDB} + V_{PDC} + V_{PDD})$$

FOCUS ERROR AMP

This amp obtains the difference between the output (VA) of the RF I-V Amp (1) and the output (VB) of the RF I-V Amp (2), then outputs the voltage which has been converted from the currents of the photodiodes (A + C - B - D).

The FE output voltage (low frequency) is as follows:

$$V_{FE} = 5.4 \times (VA - VB)$$

$$= 5.4 \times \frac{58k\Omega}{12k\Omega} \times (V_{PDA} + V_{PDC} - V_{PDB} - V_{PDD})$$

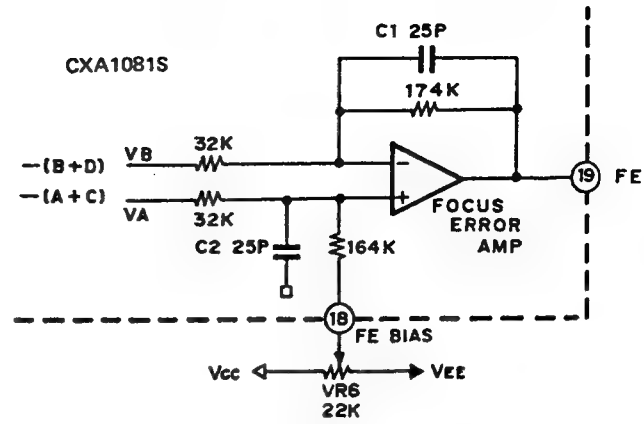


Fig. 4-13

TRACKING ERROR AMP

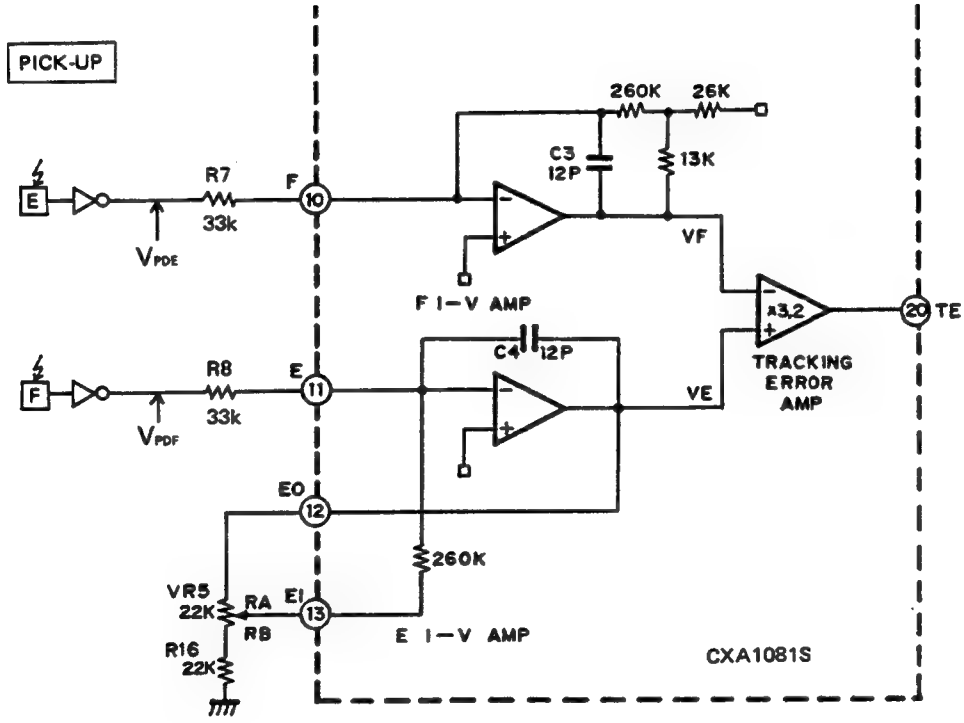


Fig. 4-14

The voltage of photodiodes for the side spots input to Terminals E and F are respectively subjected to the voltage is increased at the E I-V and F I-V Amps. That is:

$$VF = \frac{403k\Omega}{33k\Omega} \times V_{PDF}$$

$$VE = [260\ k\Omega \times RA/(RB + 22k\Omega) + (RA + 260k\Omega)]/33k\Omega \times V_{PDE}$$

Furthermore, the output difference between the E I-V and F I-V Amps is obtained at the Tracking Error Amp in order to obtain the output voltage that has been converted from currents of the photodiodes (E - F) as follows:

$$VTE = (VE - VF) \times 3.2$$

$$= (V_{PDE} - V_{PDF}) \times \frac{403k\Omega}{33k\Omega} \times 3.2$$

FOCUS OK CIRCUIT

The Focus OK circuit functions to create the window for the timing of switching ON the Focus Servo from the Focus Search status.

With respect to the RF signal of Pin ②, both its HPF signal and the reciprocal of the LPF output (inverted phase) from the Focus OK Amp output are obtained at Pin ①.

The Focus OK output is inverted in the case below:

$V_{RFI} - V_{RFO} \fallingdotseq -0.39$ V

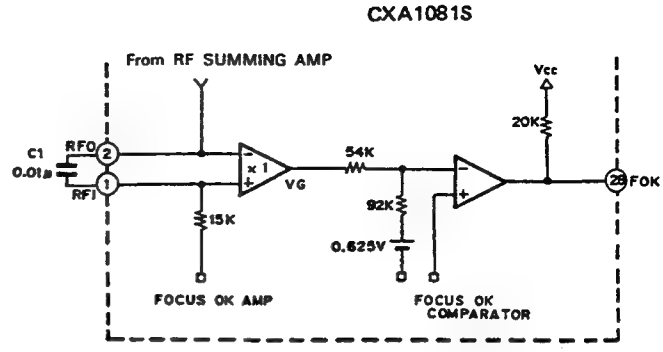


Fig. 4-15

MIRROR CIRCUIT

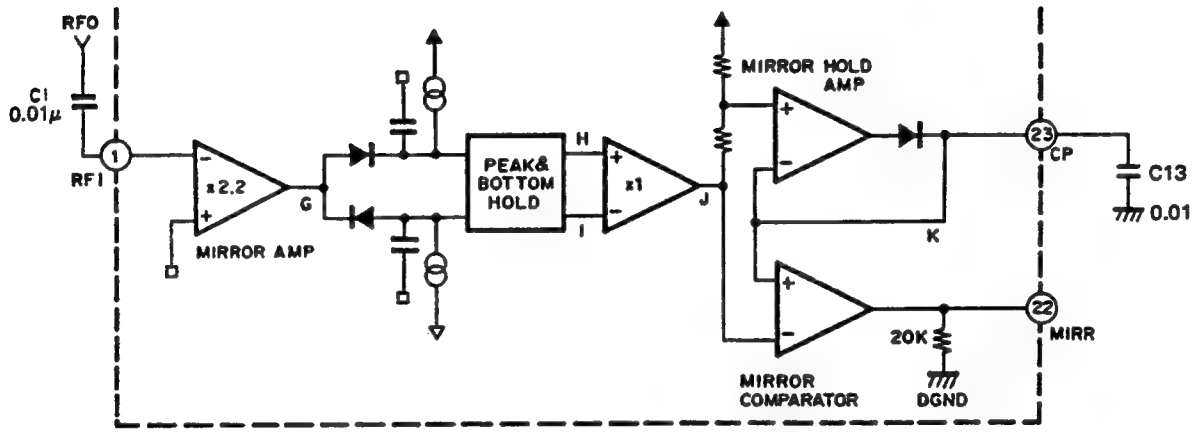


Fig. 4-16

After amplifying the RFI signal, the Mirror circuit performs Peak Hold and Bottom Hold.

Peak Hold will hold the peak value at a time constant that is capable of tracking even a 30 kHz Traverse signal, whereas Bottom Hold will hold the bottom value at a time constant that is capable of tracking even the envelope fluctuations of revolving cycles.

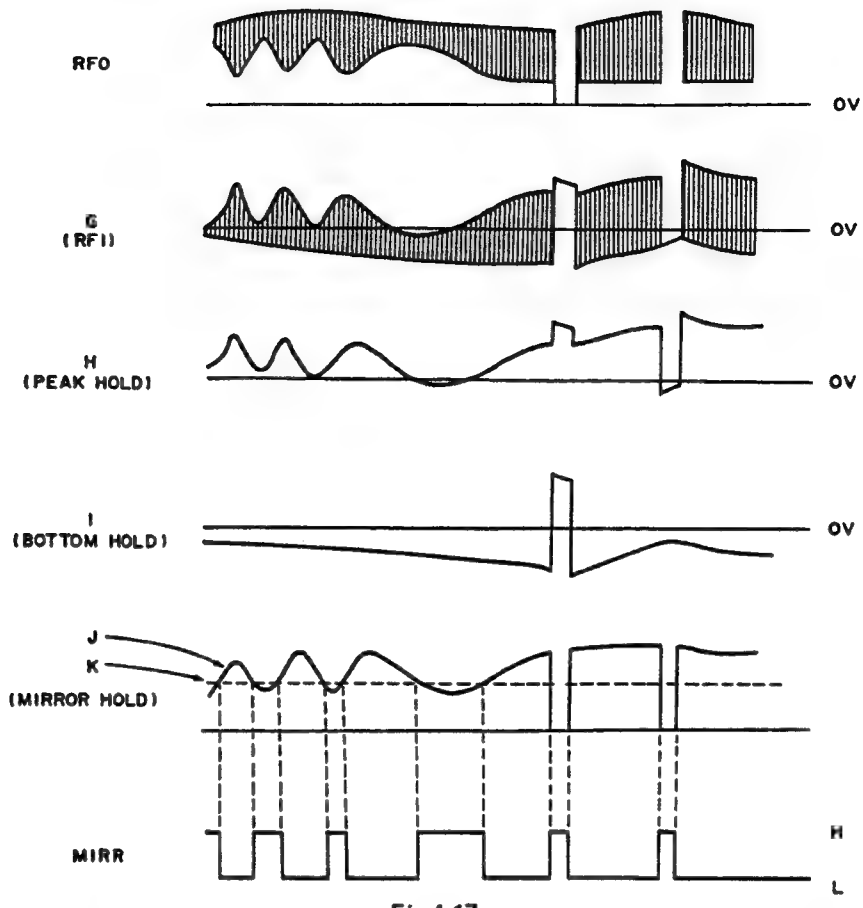


Fig.4-17

The DC-replayed Envelope signal J is obtained from the differential amplitude of these Peak and Bottom Hold signals, H and I. The Mirror output is obtained by comparing this signal J with the signal K which has been held at peak level, using a time constant of a a level that is two-thirds that of the peak value. In other words, the Mirror output is "L" upon a disc track or "H" between disc tracks (the Mirror section). Moreover, the Mirror output is also "H" when a defect has been detected.

EFM COMPARATOR

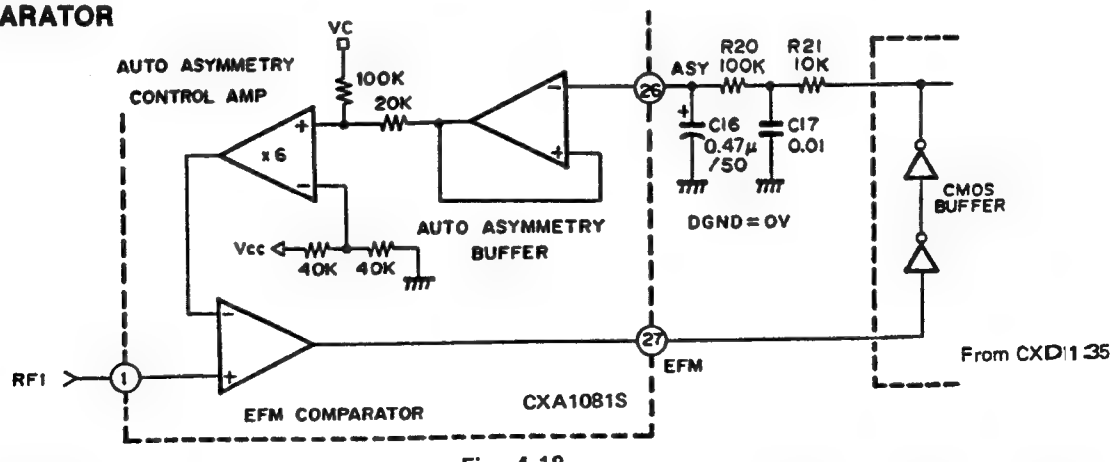


Fig. 4-18

The EFM Comparator functions to convert the RF signals into binary signals. The asymmetry caused by variance during disc manufacture cannot be eliminated merely by AC coupling. Consequently, the reference voltage of the EFM comparator is controlled by exploiting the respective 50% probability of a 1 or 0 occurring as the value of a binary-coded EFM signal.

Note that since this EFM Comparator is of power-current SW type, its H and L levels will not equal the supply voltage, there is feedback via the decoder's C-MOS Buffer.
R20, R21, C16, and C17 serve as a LPF for obtaining the DC of (Vcc + DGND)/2 [V].

DEFECT CIRCUIT

After inverting the RFI signal, the Defect circuit performs Bottom Hold using two time constants, one long and one short. The Bottom Hold performed by the short time constant sends a response at a mirror-surface defect on the disc that is 0.1 ms or longer. The Bottom Hold performed using the long time constant continues holding the mirror surface at the level preceding the defect. The Mirror Defect Detection signal is generated by performing a fine plus level shift of that mirror level by use of C coupling, then making a comparison of both signals.
When this signal is used and the DEFECT output is "H," TRKG error is muted and the playability is improved.

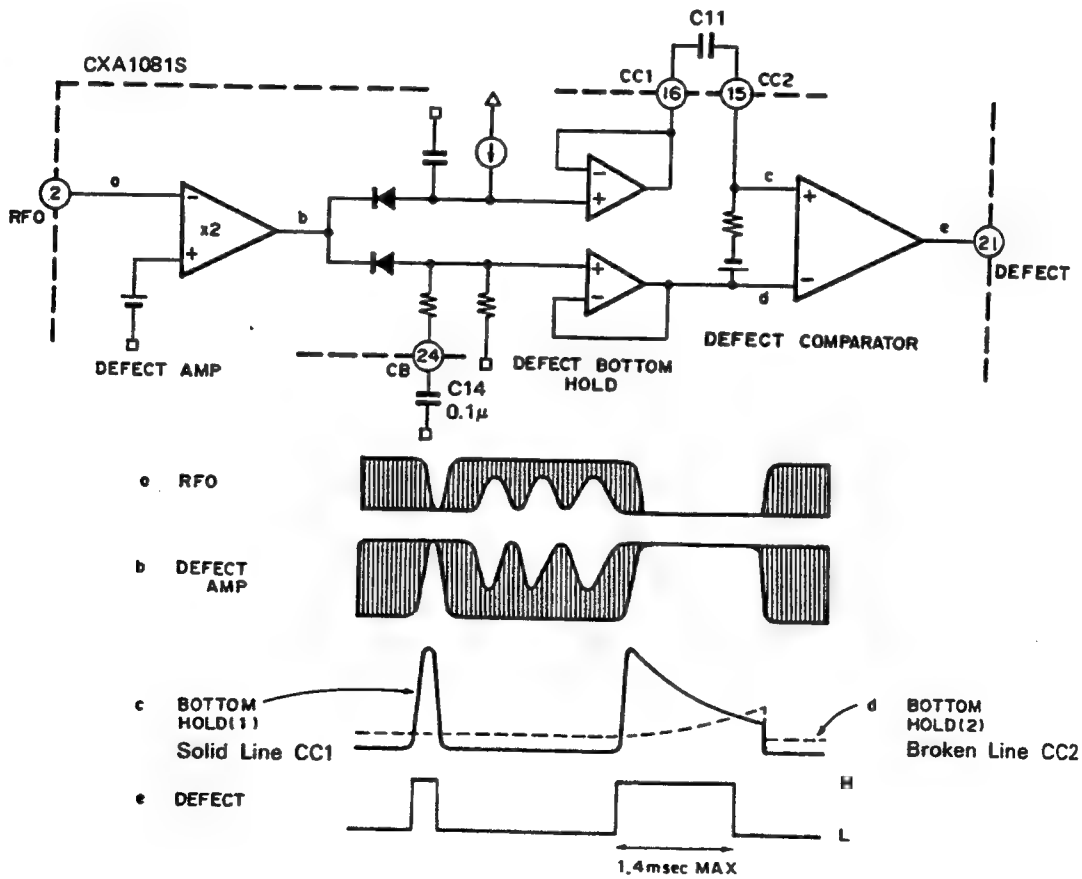


Fig. 4-19

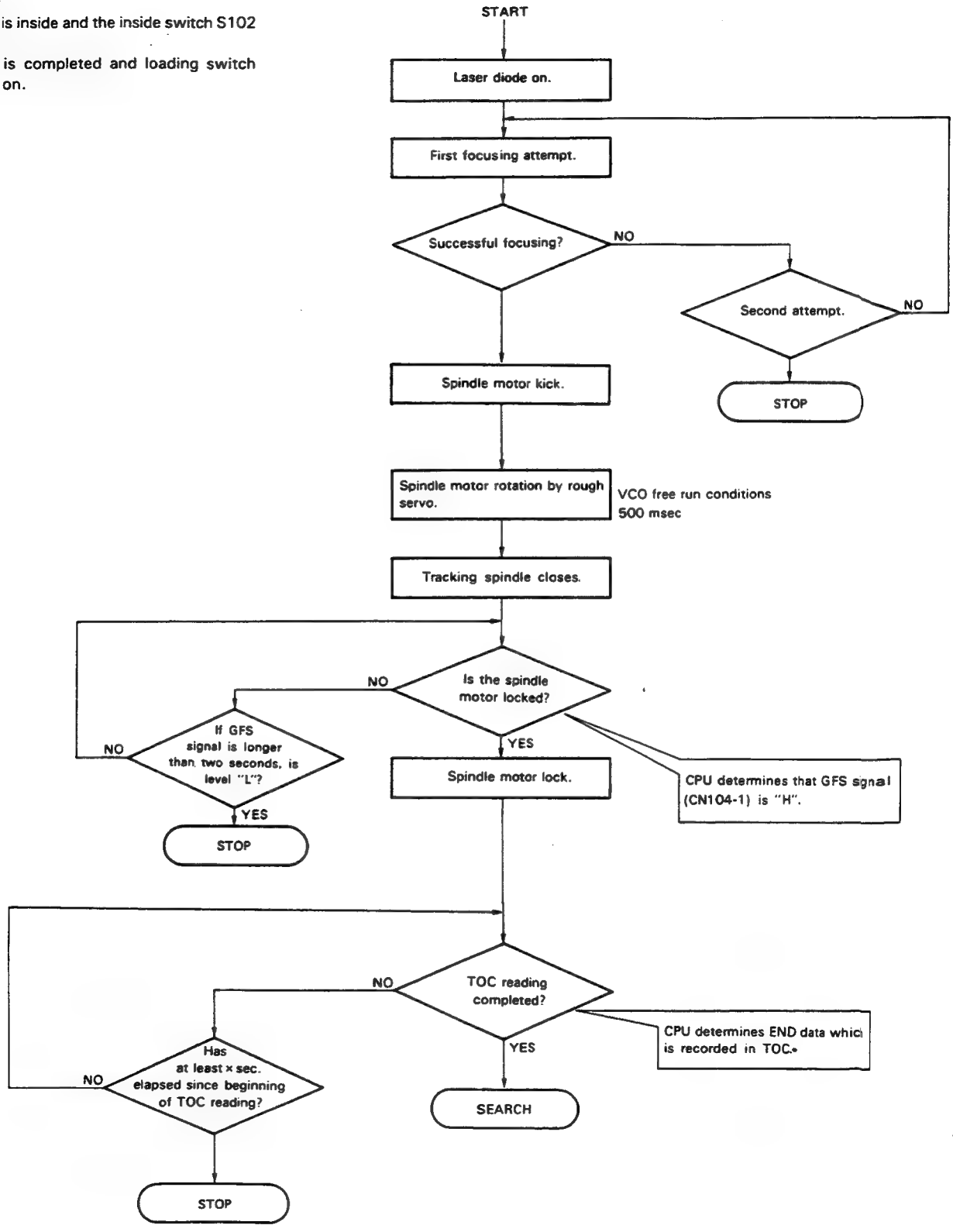
4.3 TOC READING

Initial Settings for Reading of Table of Contents

Conditions:

★ Carriage is inside and the inside switch S102 is on.

★ Loading is completed and loading switch S101 is on.



4.4 CARRIAGE SERVO SYSTEM

The carriage servo system inputs the TRKG actuator's drive voltage, and through the carriage servo EQ shown in Fig. 4-20, the amount required for the carriage movement is obtained.

Also, the carriage's LOCATE operation obtains $\overline{\text{LOCATE}}$ voltage by switching over the internal current source in the serial data. This voltage is about 6V. However, during startup and lock, since the output current is limited to 200mA, the voltage will become lower than 6V.

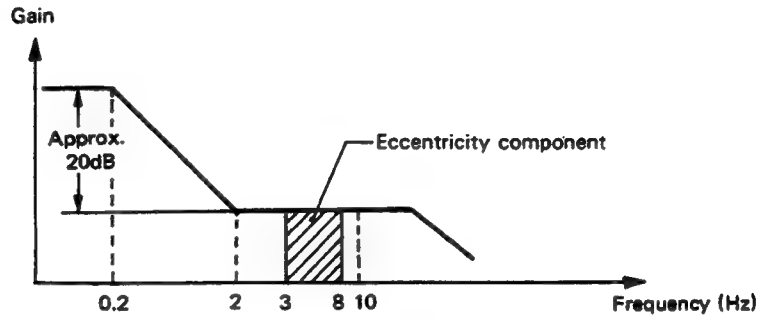


Fig. 4-20

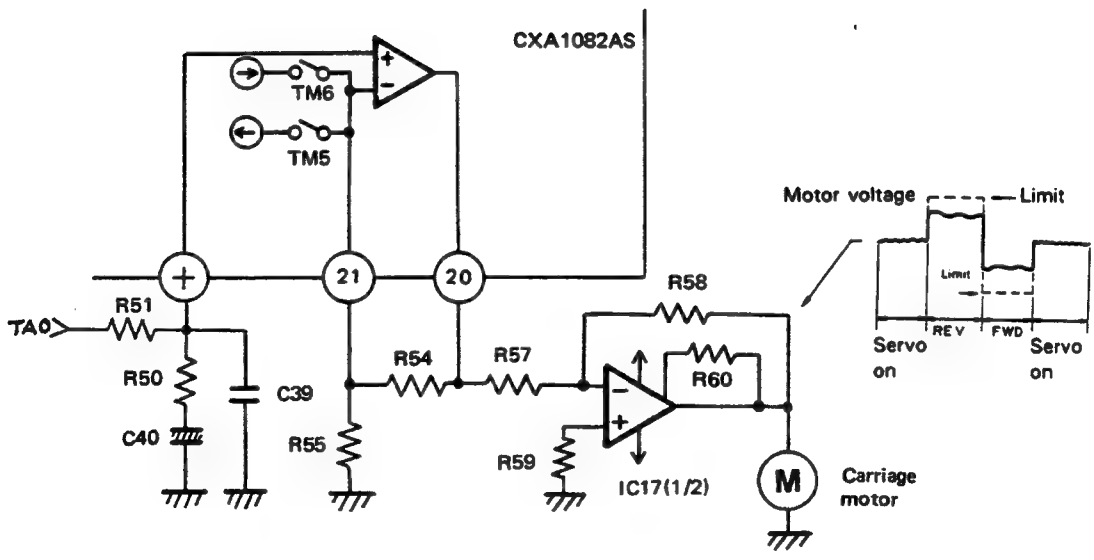


Fig. 4-21

4.5 DEMODULATOR

The demodulator is composed primarily of LSI CXD1135Q; it also includes a small amount of added-on circuits. Its functions are:

1. Bit clock regeneration using the EFM-PLL circuit.
2. Demodulation of the EFM data.
3. Detection, protection and internal extension of the frame sync signal.
4. Thorough error detection and correction.
5. Interpolation using averaging or previous value hold.
6. Demodulation of the sub-code and error detection for sub-code Q.
7. CLV servo for the spindle motor.
8. 8-bit tracking counter.
9. CPU interface using the serial bus.
10. Built-in 35th digital filter.

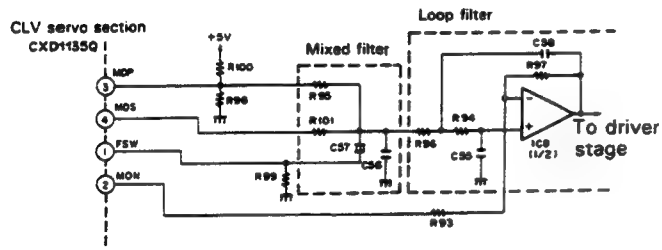


Fig. 4-22

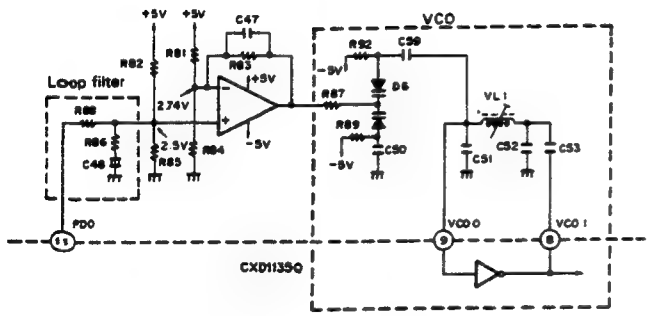


Fig. 4-23

4.6 DIGITAL LEVEL CONTROL (Only for PD-7050 and PD-7050-S)

Instead of the previous method, place a digital attenuator IC in front of the audio circuit. By controlling the output level with an 8-bit data of the microcomputer and a 16-bit audio signal from the digital circuit and multiplying both within the attenuator IC, it is possible to obtain an audio signal which does not damage the quality of the audio circuit. (See Fig. 4-24) By operating the UP/DOWN key of the remote controller, every 1 dB of 25 steps (0 dB to–25 dB) level adjustment.

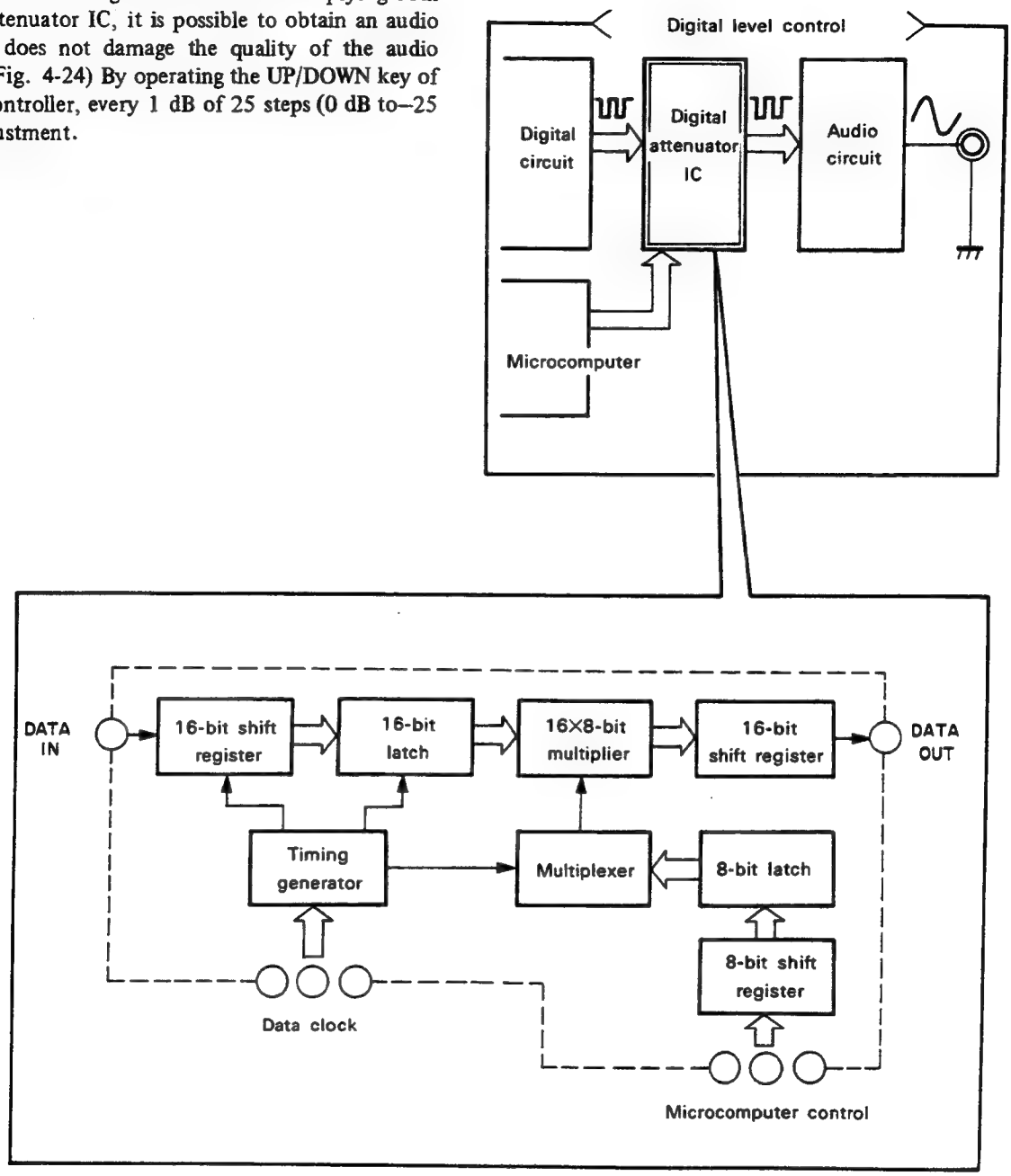


Fig. 4-24 Digital level control

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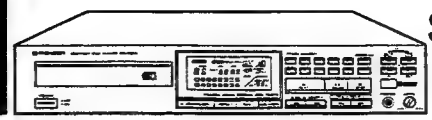
Service Manual



SERVICE GUIDE
ORDER NO.
ARP1352

COMPACT DISC PLAYER

PD-7050
PD-7050-S
PD-6050
PD-6050-S
PD-5050
PD-5050-S
PD-4050
PD-4050-S

- For the servicing these models, please refer to the following service manual.
- PD-7050/KU, KC, HEM, HB, SD types and PD-7050-S/HEM type; ARP1331
- PD-6050/KU, KC, HEM, HB, SD, SD/G types and PD-6050-S/HEM type; ARP1329
- PD-5050/HEM, HB types and PD-5050-S/HEM type; ARP1330
- PD-4050/KU, KC, HEM, HB, HP, SD, SD/G types and PD-4050-S/HEM, HB types; ARP1332

CONTENTS

PIONEER ELECTRONIC CORPORATION 4-1, Meguro 1-Chome, Meguro-ku, Tokyo 153, Japan
PIONEER ELECTRONICS SERVICE INC. P.O. Box 1760, Long Beach, California 90801 U.S.A.
PIONEER ELECTRONICS OF CANADA, INC. 505 Cochrane Drive, Markham, Ontario L3R 6B8 Canada TEL: [416] 479-4411
PIONEER ELECTRONIC [EUROPE] N.V. Keetberglaan 1, 2740 Beveren, Belgium TEL: 03/775 · 28 · 08
PIONEER ELECTRONICS AUSTRALIA PTY. LTD. 178-184 Boundary Road, Braeside, Victoria 3195, Australia TEL: [03] 580-9911

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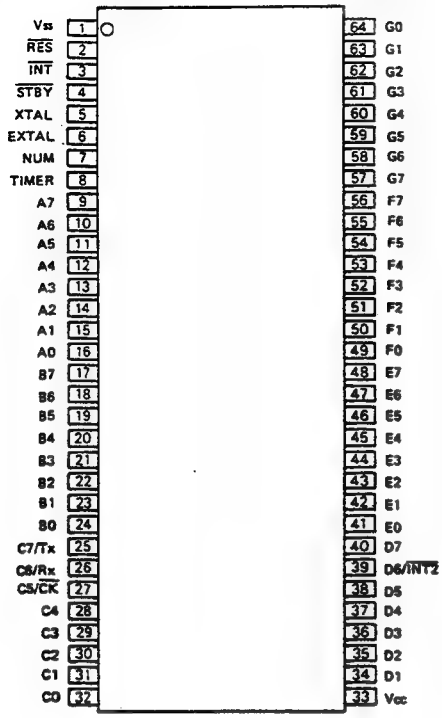
1. IC DATA

1.1 PD3091A (Only for PD-7050 and PD-7050-S types)



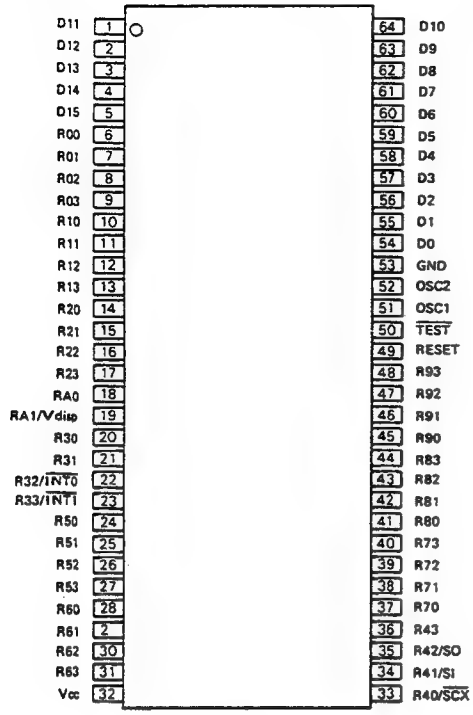
(Top view)

Terminal description

No	SYMBOL	NAME	I/O	OPERATING DESCRIPTION
1	Vss	———	—	GND
2	$\overline{RES}$	REST	I	CPU RESET input — RESET | RUN
3	$\overline{INT}$	SCOR	I	SUBCODE SYNC input — SYNC
4	$\overline{STBY}$	———	I	+5V (CPU Standby input) — STANDBY | RUN
5	XTAL	———	—	Internal Clock Circuit input
6	EXTAL	———	—	Internal Clock Circuit input
7	NUM	———	—	GND (for manufacturer's use)
8	TIMER	Not used	I	(Connected to SEMS)
9	A7	$\overline{TEST}$	I	TEST Mode Select input
10	A6	$\overline{ALAT}$	O	Attenuation Level Latch Pulse output — RUN
11	A5	ADAT	O	Attenuation Level data — 0 1 2 3 4 5 6 7
12	A4	ACLK	O	Attenuation Level clock
13	A3	SRES	O	Key-Display Microcomputer RESET output — RUN | RESET
14	A2	$\overline{XLT}$	O	LSI Control Data RUN Pulse output — RUN
15	A1	Not used	O	(OPEN)
16	A0	Not used	O	(OPEN)
17	B7	$\overline{CLMP}$	I	Disc CLAMPed SW input — CLAMP | NOT
18	B6	$\overline{OPEN}$	I	Disc Tray OPENed SW input — OPEN | NOT
19	B5	$\overline{INSD}$	I	Slider Inside SW input — INSIDE | NOT
20	B4	SENS	I	LSI Operating Status Multi-Mode input
21	B3	CPCF	I	SUBCODE Q-CRC Result input — NG | OK
22	B2	GFS	I	FRAME SYNC Lock input — NG | LOCK
23	B1	Not used	I	Connected to GND

No	SYMBOL	NAME	I/O	OPERATING DESCRIPTION
24	B0	FOK	I	Focus OK input — NG / OK
25	TX(SO)	DATA	O	LSI Control Data Serial output — 0 1 2 3 4 5 6 7
26	RX(SI)	SUBQ	I	SUBCODE Q Data input
27	$\overline{CK}$	CLK	O	Serial Transmission clock
28	C4	$\overline{LDON}$	O	Laser Diode ON/OFF output — ON / OFF
29	C3	MUTG	O	Muting ON/OFF output — OFF / ON
30	C2	$\overline{DEMP}$	O	De-emphasis ON/OFF output — ON / OFF
31	C1	CLVH	O	During Spindle CLV-H = "H" — CLV-H
32	C0	Not used	O	
33	Vcc	———	—	+5V
34	D1	KD0	I	Main Unit Key Code input (LSB)
35	D2	KD1	I	Main Unit Key Code input (LSB)
36	D3	KD2	I	Main Unit Key Code input (LSB)
37	D4	KD3	I	Main Unit Key Code input (LSB)
38	D5	KD4	I	Main Unit Key Code input (MSB)
39	D6	$\overline{KS}$	I	Main Unit Key Strobe input — ON / OFF
40	D7	STS	I	Enable Display Data Send input — DISABLE / ENABLE
41	E0	SCK	O	Display Data Serial Transmission Clock
42	E1	SD	O	Display Data Serial output
43	E2	LIN	O	Disk Tray Loading — Free & Break / IN
44	E3	LOUT	O	IN/OUT output — OUT
45	E4	Not used	O	(OPEN)
46	E5	Not used	O	(OPEN)
47	E6	Not used	O	(OPEN)
48	E7	Not used	O	(OPEN)
49	F0	Not used	O	(OPEN)
50	F1	Not used	O	(OPEN)
51	F2	Not used	O	(OPEN)
52	F3	$\overline{ATTL}$	O	FL: [ATT, –, dB] Segment output — ON / OFF
53	F4	$\overline{IDXL}$	O	FL: [INDEX] Segment output — ON / OFF
54	F5	$\overline{WDWL}$	O	FL: [MUSIC WINDOW] Segment output — ON / OFF
55	F6	PLYL	O	Play LED output — OFF / ON
56	F7	PASL	O	Pause LED output — OFF / ON
57	G7	Not used	I	Connected to +5V
58	G6	$\overline{RKS}$	I	Remote-Control Key Strobe input — ON / OFF
59	G5	RKD5	I	Remote-Control Key Code input (MSB)
60	G4	RKD4	I	Remote-Control Key Code input (MSB)
61	G3	RKD3	I	Remote-Control Key Code input (MSB)
62	G2	RKD2	I	Remote-Control Key Code input (MSB)
63	G1	RKD1	I	Remote-Control Key Code input (MSB)
64	G0	RKD0	I	Remote-Control Key Code input (LSB)

1.2 PD3092A (Only for PD-6050, PD-6050-S, PD-5050 and PD-5050-S types)



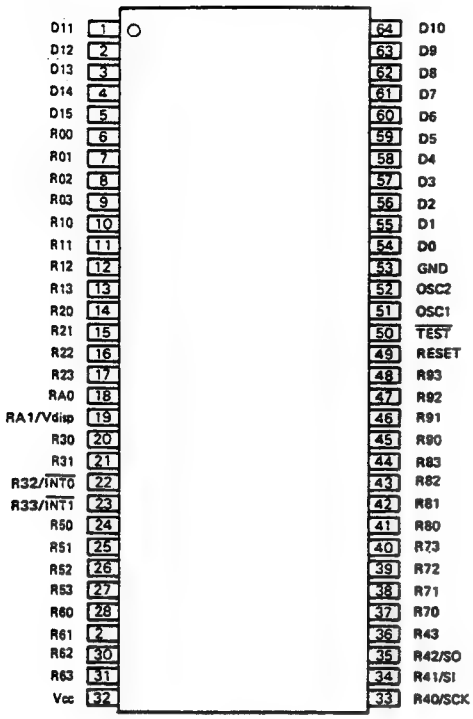
(Top view)

Terminal description

No	SYMBOL	I/O	NAME	DESCRIPTION
1	D11	O	DIG2	Digital output for FL driving ON 5V −26V
2	D12	O	DIG3	Digital output for FL driving
3	D13	O	DIG4	Digital output for FL driving
4	D14	O	DIG5	Digital output for FL driving
5	D15	O	DIG6	Digital output for FL driving
6	R00	O	SEG.a	Segment output for FL driving ON 5V OFF −26V
7	R01	O	SEG.b	Segment output for FL driving ON OFF
8	R02	O	SEG.c	Segment output for FL driving ON OFF
9	R03	O	SEG.d	Segment output for FL driving ON OFF
10	R10	O	SEG.e	Segment output for FL driving ON OFF
11	R11	O	SEG.f	Segment output for FL driving ON OFF
12	R12	O	SEG.g	Segment output for FL driving ON OFF
13	R13	O	SEG.h	Segment output for FL driving ON OFF
14	R20	I	KD0	Key Scan input Key key IN 5V −26V
15	R21	I	KD1	Key Scan input Key
16	R22	I	KD2	Key Scan input Key
17	R23	I	KD3	Key Scan input Key
18	RA0	I	Not used	(GND)
19	Vdisp	—	———	Buffer power for FL driving (−26V)
20	R30	I	Not used	(GND)
21	R31	O	$\overline{XLT}$	LSI Control Data Latch pulse
22	$\overline{INTO}$	I	SCOR	SUBCODE SYNC S0+S1 input SYNC
23	R33	I	SENS	LSI Operating Status Multi-Mode input

No	SYMBOL	I/O	NAME	DESCRIPTION
24	R50	I	CRCF	SUBCODE Q-CRC Result input NG/OK
25	R51	I	GFS	Frame Sync Lock input NG/LOCK
26	R52	I	Not used	(GND)
27	R53	I	FOK	Focus OK input NG/OK
28	R60	O	$\overline{\text{LDON}}$	Laser Diode ON/OFF output ON/OFF
29	R61	O	MUTE	Muting ON/OFF output OFF/ON
30	R62	O	$\overline{\text{DEMP}}$	De-emphasis ON/OFF output ON/OFF
31	R63	O	CLVH	(CLV/H select output) OFF/ON
32	VCC	—	——	+5V
33	$\overline{\text{SCK}}$	O	CLK	Serial clock
34	SI	I	SUBQ	SUBCODE Q Data Serial input 3 2 1 0 7 6 5 4
35	SO	O	DATA	LSI Control Data Serial output 0 1 2 3 4 5 6 7
36	R43	I	$\overline{\text{TEST}}$	TEST Mode Select input TEST/NORMAL
37	R70	O	Not used	(NC)
38	R71	O	Not used	(NC)
39	R72	O	Not used	(NC)
40	R73	O	Not used	(NC)
41	R80	O	Not used	(NC)
42	R81	O	Not used	(NC)
43	R82	O	LIN	Disc Tray Loading _/IN
44	R83	O	LOUT	IN/OUT output BRAKE/OUT
45	R90	I	$\overline{\text{OPEN}}$	Disc Tray OPENed SW input OPEN/NOT
46	R91	I	$\overline{\text{CLMP}}$	Disc CLAMPed SW input CLAMP/NOT
47	R92	I	$\overline{\text{INSD}}$	Slider Inside SW input INSIDE/NOT
48	R93	I	Not used	(GND)
49	Reset	—	——	CPU Reset input Reset/RUN
50	$\overline{\text{TEST}}$	—	——	+5V
51	OSC1	I	——	Clock Circuit input
52	OSC2	O	Not used	
53	GND	—	——	GND
54	D0	I	$\overline{\text{RKS}}$	Remote-Control Strobe input IN/OFF
55	D1	I	RKD5	Remote-Control Code input (MSB)
56	D2	I	RKD4	Remote-Control Code input (MSB)
57	D3	I	RKD3	Remote-Control Code input (MSB)
58	D4	I	RKD2	Remote-Control Code input (MSB)
59	D5	I	RKD1	Remote-Control Code input (MSB)
60	D6	I	RKD0	Remote-Control Code input (LSB)
61	D7	O	Not used	(NC)
62	D8	O	Not used	(NC)
63	D9	O	DIG0	Digital output for FL driving _/ON +5V –26V
64	D10	O	DIG1	Digital output for FL driving _/ON

1.3 PD3093A (Only for PD-4050 and PD-4050-S types)



(Top view)

Terminal description

No	SYMBOL	I/O	NAME	DESCRIPTION
1	D11	O	REPL	REPEAT-LED ON/OFF — ON | OFF
2	D12	O	Not used	(NC)
3	D13	O	PGML	PROGRAM-LED ON/OFF — ON | OFF
4	D14	O	DIG0	Digital output — ON | OFF
5	D15	O	DIG1	Digital output — ON | OFF
6	R00	O	SEG.a	Segment output for LED — ON | OFF 0V
7	R01	O	SEG.b	Segment output for LED
8	R02	O	SEG.c	Segment output for LED
9	R03	O	SEG.d	Segment output for LED
10	R10	O	SEG.e	Segment output for LED
11	R11	O	SEG.f	Segment output for LED
12	R12	O	SEG.g	Segment output for LED
13	R13	I	KD0	Key Scan input — ON | OFF
14	R20	I	KD1	Key Scan input — ON | OFF
15	R21	I	KD2	Key Scan input — ON | OFF
16	R22	I	KD3	Key Scan input — ON | OFF
17	R23	I	KD4	Key Scan input — ON | OFF
18	RA0	I	Not used	(GND)
19	Vdisp	—	———	Buffer power supply GND
20	R30	I	Not used	(GND)
21	R31	O	$\overline{XLT}$	LSI Control Data Latch pulse
22	$\overline{INT0}$	I	SCOR	SUBCODE SYNC S0+S1 input — SYNC
23	R33	I	SENS	LSI Operating Data Multi-Mode input

No	SYMBOL	I/O	NAME	DESCRIPTION
24	R50	I	CRCF	SUBCORD Q-CRC Result input NO/OK
25	R51	I	GFS	Frame Sync Lock input NG/LOCK
26	R52	I	Not used	(GND)
27	R53	I	FOK	Focus OK input NG/OK
28	R60	O	$\overline{\text{LDON}}$	Laser Diode ON/OFF output ON/OFF
29	R61	O	MUTE	Muting output ON/OFF
30	R62	O	$\overline{\text{DEMP}}$	De-emphasis ON/OFF output ON/OFF
31	R63	O	Not used	(NC)
32	VCC	—	——	+5V
33	$\overline{\text{SCK}}$	O	CLK	Serial clock
34	SI	I	SUBQ	SUBCODE Q Data Serial input
35	SO	O	DATA	LSI Control Data Serial output 0 1 2 3 4 5
36	R43	I	$\overline{\text{TEST}}$	TEST Mode Select input TEST/NORMAL
37	R70	O	Not used	(NC)
38	R71	O	Not used	(NC)
39	R72	O	Not used	(NC)
40	R73	O	Not used	(NC)
41	R80	O	Not used	(NC)
42	R81	O	Not used	(NC)
43	R82	O	LIN	Disc Tray Loading IN
44	R83	O	LOUT	IN/OUT output BRAKE/OUT
45	R90	I	$\overline{\text{OPEN}}$	Disc Tray OPENed SW input OPEN/NOT
46	R91	I	$\overline{\text{CLMP}}$	Disc CLAMPed SW input CLAMP/NOT
47	R92	I	$\overline{\text{INSD}}$	Slider Inside SW input INSIDE/NOT
48	R93	I	Not used	(GND)
49	Reset	—	——	CPU Reset input $\overline{\text{Reset}}$/RUN
50	$\overline{\text{TEST}}$	—	——	+5V
51	OSC1	I	——	Clock Circuit input
52	OSC2	O	——	(Internal Clock Circuit output)
53	GND	—	——	GND
54	D0	I	$\overline{\text{RKS}}$	Remote-Control Key Strobe input IN/OFF
55	D1	I	RKD5	Remote-Control Key Code input (MSB)
56	D2	I	RKD4	Remote-Control Key Code input (MSB)
57	D3	I	RKD3	Remote-Control Key Code input (MSB)
58	D4	I	RKD2	Remote-Control Key Code input (MSB)
59	D5	I	RKD1	Remote-Control Key Code input (MSB)
60	D6	I	RKD0	Remote-Control Key Code input (LSB)
61	D7	O	Not used	(NC)
62	D8	O	Not used	(NC)
63	D9	O	PLYL	DLAY-LED ON/OFF ON 5V 0V
64	D10	O	PASL	PAUSE-LED ON/OFF ON 5V 0V

2. OPTICAL PATH IN THE PICK-UP

2-1 OPTICAL PATH AND OPTICAL PARTS

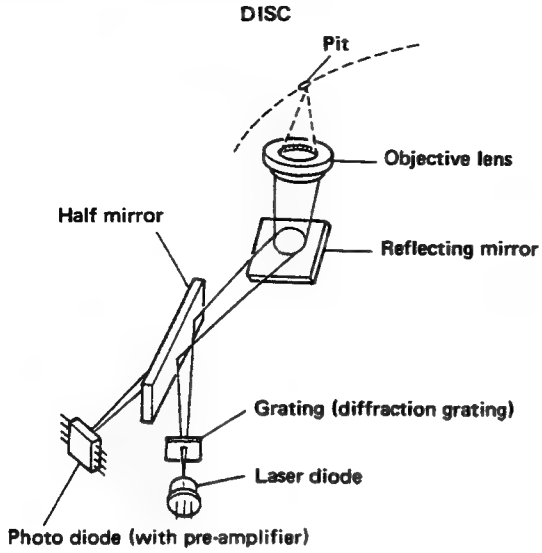


Fig. 2-1 shows the configuration of this pick-up's optical part.

The wavelength of the light emitted from the laser diode is between 780 and 790 nm. The light is barely visible. This light source is spread into an ellipse from an ultra-small emission point. The light expands at a set angle.
The emitted light goes through a grating and is divided into three beams of 0 step and ±1 step.
The other beams of ±2, 3, and n steps are also present, but are lost and not used. When the light reaches the half mirror, 50% is reflected. The remaining light permeates the half mirror and is lost.
The light then goes to the reflecting mirror where all the light is reflected to the objective lens (finite type).
Since this pick-up's objective lens uses a finite system (finite because the LD's convergence distance is finite), a collimator lens is unnecessary. The old models objective lenses are called infinite type. The light that is converged on an ultra-small diameter spot by these objective lenses is reflected by the disc and returns to the objective lens. Then it goes through the half mirror where 50% of it returns to the laser diode. The remaining 50% of light goes through and reaches the photo diode.
This has been a general outline of the optical path. The features of each part are explained in the following section.

2-2 FEATURE OF EACH PART

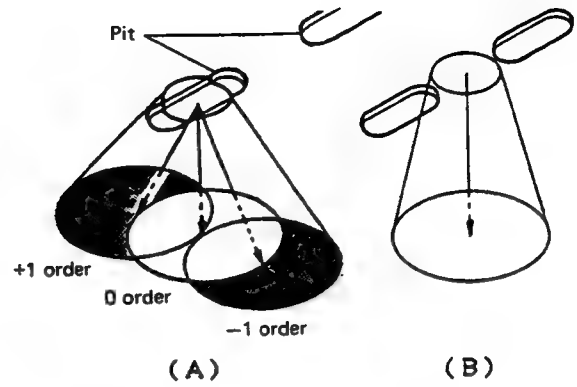


Fig. 2-2

(1) Laser diode (LD)

The size of previously-used LDs was 9ϕ. However, a newly-developed LD with a size of 5.6ϕ has been introduced. This has resulted in a compact and lightweight optical path.

(2) Objective lens

The collimator lens has been replaced by the finite objective lens which has a finite convergence distance for the LD's optical path. This has resulted in lower costs while preserving high performance.
The finite objective lens, like the conventional infinite lens, is a high-performance lens designed to attain sufficient optical performance even when the optical parts are not parallel within the optical path.

(3) Half mirror

The light that returns to the objective lens goes through the half mirror. Since the half mirror is a glass plate, it is known that astigmatism is created for the light which enters at an angle. The old model similarly used a glass plate and had a device in its optical part to cancel this astigmatism. Whereas, this new pick-up uses the astigmatism advantageously for the focus servo.
Consequently, the multi-lens used in previous models has not been incorporated in this new pick-up. This has resulted in lower costs while preserving high performance. At the same time, the points of parts have been reduced, improving dispersion and reliablity.

(4) Axle-sliding actuator

The position accuracy of the objective lens is an important factor for the optical pick-up. The pick-up has a sliding axle for the actuator which drives the objective lens. Accurate and stable positioning of the objective lens is thus attained, resulting in stable trackability. Also, a smooth frequency response with low resonance is also realized as with the conventional spring-supported type.

(5) Resin body

The CD body has been made with computer-simulated technology. To keep body changes to a minimum, resin has been incorporated. Due to the mounting, materials were carefully selected and the same reliability as the previously-used aluminum has been realized.

The use of resin has made possible mounting configurations that were not possible with aluminum. Therefore the use of adhesives has been greatly reduced for improved reliability.

2-3 RF and servo signal

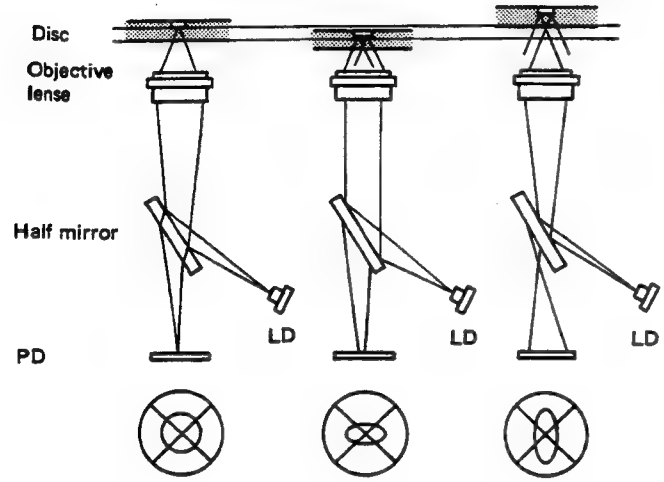


Fig. 2-3

(2) RF and servo signals

The beam, which has been reduced to an extremely small spot by the objective lens, now strikes the disc side on which the signal is located. Part of the beam is then reflected back to the objective lens and photo diode. A diagram showing how this beam is reflected off the disc is shown in figure 2-2. (A) shows what happens when the concentrated beam is directed at a pit. Normally, this reflected light would disrupt the output light beam. In the laser diodes used in CD players, however, noise is reduced instead, resulting in stable performance. This property is very advantageous for the half prism which allows only half of the light energy to pass.

A pit and (B) shows the same beam when reflected from a space between pits. In case (A), the beam is diffracted, so the dark part of the beam does not return to the objective lens. Instead, only the center of the beam passes through the objective lens and reaches the photo diode. In case (B), there is no diffraction because the beam does not strike a pit. Therefore, the entire beam is reflected back to the photo diode, producing brighter beam than when a pit is reached. In this system, the data on the disc, which is represented by pits, is covered into an electrical signal at the photo diode according to the intensity (brightness) of the reflected beam. The RF signal is then produced from this electrical signal by the computation circuit.

Fig. 2-3 shows how the focus signal is detected. (1) is when the beam from the laser diode is accurately focused on the disc by the objective lens. (2)shows what happens when the disc comes closer to the pickup and (3) shows what happens when the disc moves farther away. The grating and concave lens, which have no direct effect on the focusing are not shown in the diagram.

In case (1), the beam emanating from point 01 is reflected and diffracted on the disc surface to produce the condensed beam (02). In case (2), the beam is directed at a point farther than that of beam 02. Fig. 2-4 shows the properties of the half mirror. 1 through 7 shows the shape of the beam at each point. Between points 2 and 6, which are in a straight line, the beam is circular at point 4. Point 6 corresponds to beam 02 of fig. 2-3. If we assume that fig. 2-4 shows mode (1) of fig. 2-3, that means the beam is circular because the photo diode is located at point 4. In mode (2) of fig. 2-3, the location of the photo diode is closer to the cylindrical lens than it was in fig. 2-4. That means the shape of the beam is the same as that of point 3 (an ellipse that has a longer width than height). In mode (3) of fig. 2-3, the shape of the beam is that of point 5, an ellipse that has a longer height than width.

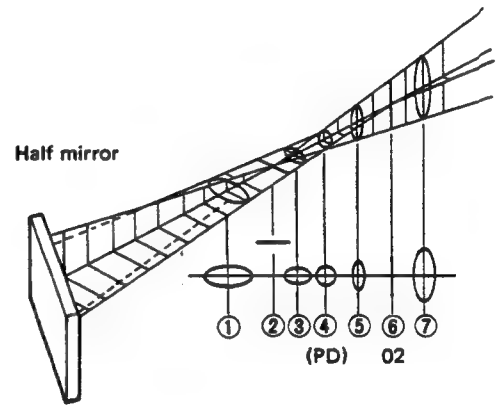


Fig. 2-4 Half mirror

These beam shapes are shown in fig. 2-3. By performing a (A + C) – (B + D) computation using the A-D photo diode quartering elements, the focus signal is produced.

Let's consider what happens as the objective lens is gradually moved closer to the disc. If the objective is fairly far from the disc, only a small amount of light will be returned to the photo diode. Furthermore, since the returning light is quartered, the focus signal would be 0.

If the objective lens is moved closer to the disc until point 7 of fig. 2-4 is reached, the shape of the beam at the photo diode becomes an ellipse that is higher than it is wide.

The focus signal would then be positive because (A + C) is greater than (B + D). However, after the peak (vertical line) is reached at point 6, it begins to return to zero. If it becomes zero at point 4, the beam becomes an ellipse that is wider than it is high because (A + C) is less than (B + D) and the focus signal becomes negative. After peaking at point 2, the focus signal returns to zero just as when the objective lens is too far from the disc. Focusing signals produced in the above manner are shown in fig. 2-5. Due to its shape, this is called an S-curve, an important graph that expresses the properties of the focus signal.

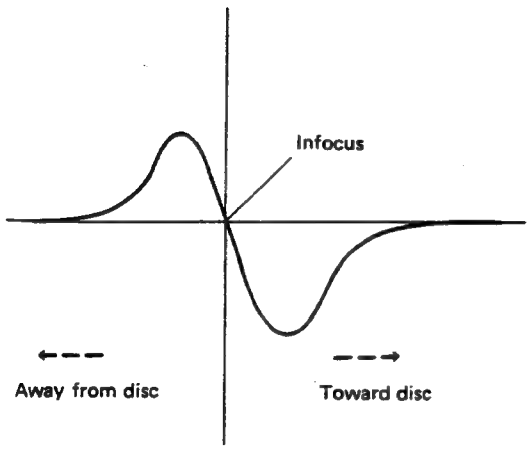


Fig. 2-5 S-curve

Since the real purpose of the focus servo is to maintain the focus signal at zero, only a tiny section at the center of the S-curve appears as residual error.

Fig. 2-6 shows how the tracking signal is detected. The beam from the laser diode is divided into three beams. The ±1 order beams on either side of the 0 order beam are used to produce the tracking signal. These two beams are, like the 0 order beam, are directed at the disc in a tiny spot. In principle, the spots of the two side beams are an equal distance from the center spot as shown in fig. 2-6. (The actual distance is much greater than that shown in the figure.) These two side beams are reflected and diffracted and returned to their respective detection elements in the photo diode. If these two elements detect the same intensity from both beams, it can be assumed that the primary (0 order) beam is correctly following the line of pits on the disc. Fig. 2-7 shows the relationship between the track and the output of each photo diode element (A, B and C).

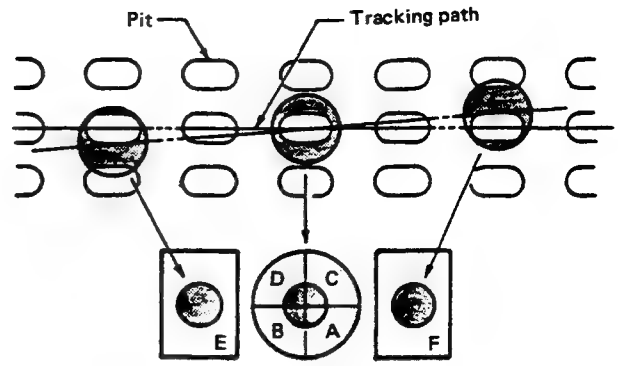


Fig. 2-6 Detection of tracking error

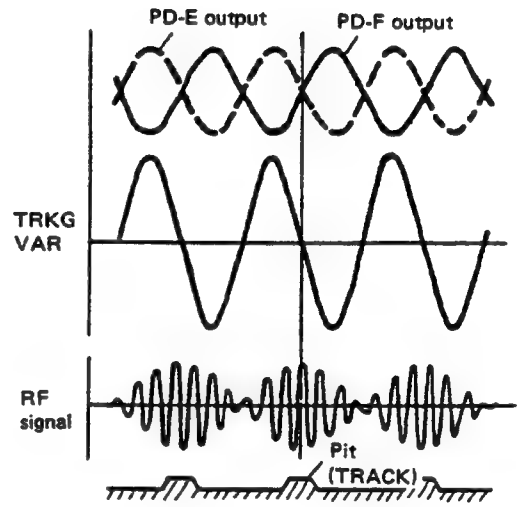


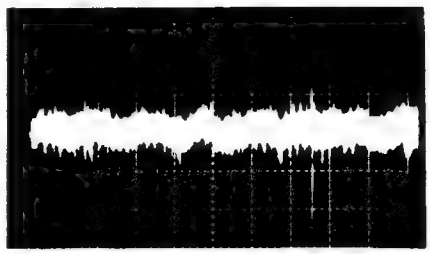
Fig. 2-7 Tracking error and the RF signal

WAVE FORMS

NOTE: The encircled numbers denote measuring points in the circuit and pattern diagrams.

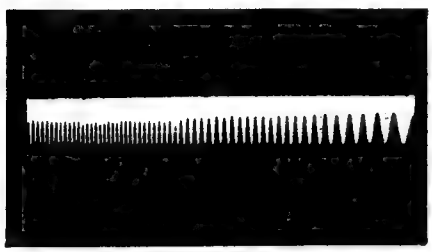
① CN1-5 Pin: PLAY MODE
100mV/Div 5m sec/Div

③ TP1-6 Pin: SEARCH MODE
500mV/Div 10mS/Div

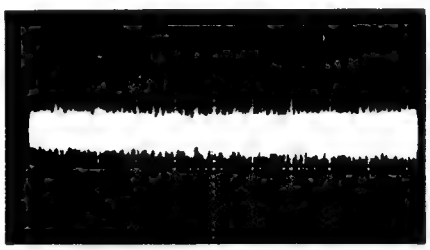


⑥ Q6E: PLAY MODE
2V/Div 10mS/Div

① CN1-5 Pin: SEARCH MODE
100mV/Div 5m sec/Div



④ TP1-2 Pin: PLAY MODE
1V/Div 10mS/Div

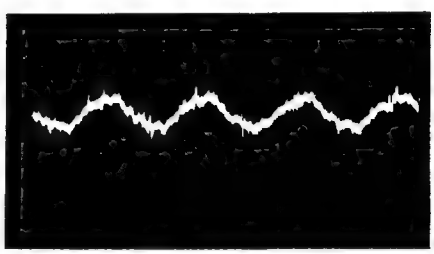


⑥ Q6E: SEARCH MODE
2V/Div 10mS/Div

② TP1-1 Pin: PLAY MODE
1V/Div 200n sec/Div

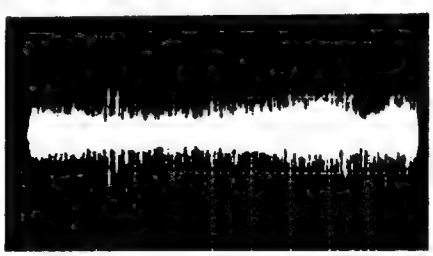
④ TP1-2 Pin: SEARCH MODE
1V/Div 10mS/Div

⑦ Q2E: PLAY MODE
2V/Div 50mS/Div

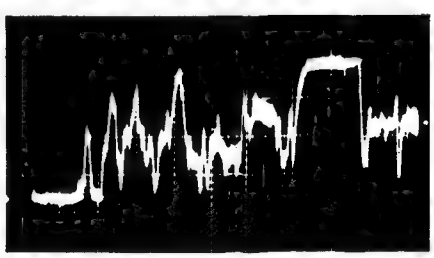


② TP1-1 Pin: SEARCH MODE
500mV/Div 5m sec/Div

⑤ Q4 Emitter: PLAY MODE
2V/Div 10mS/Div



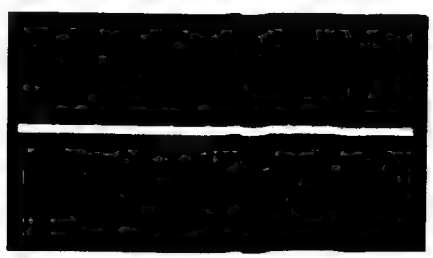
⑦ Q2E: SEARCH MODE
2V/Div 100mS/Div

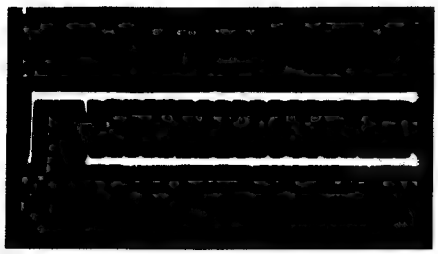
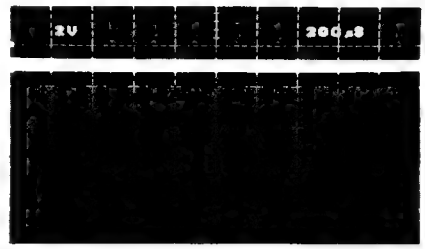
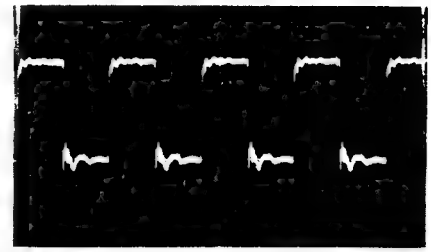
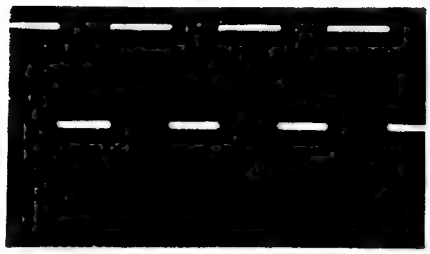
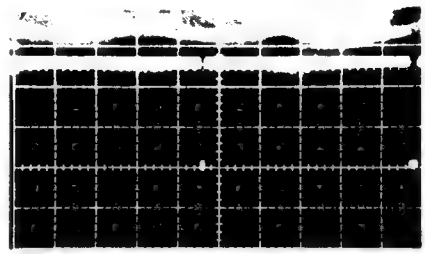
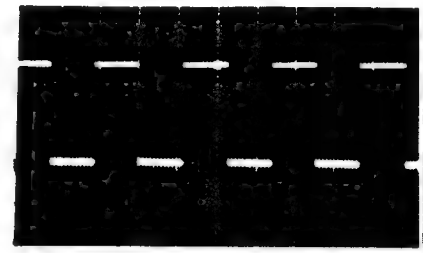
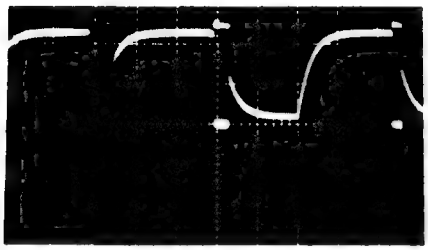
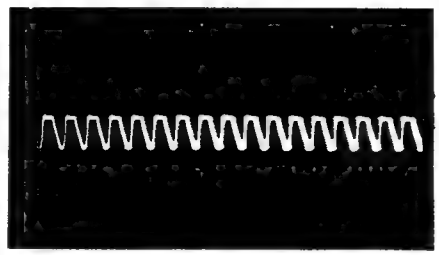
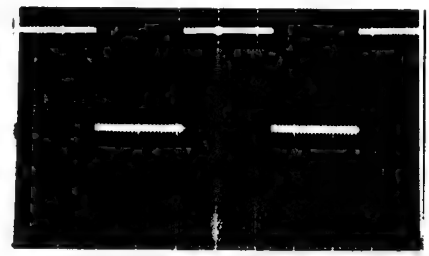
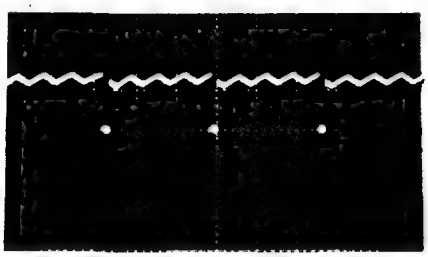
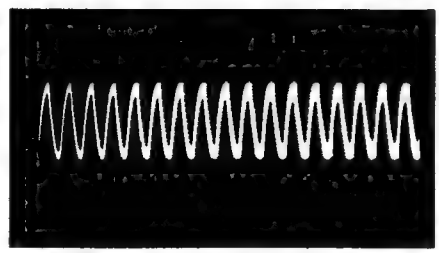
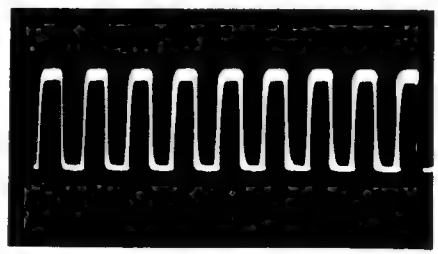


③ TP1-6 Pin: PLAY MODE
500mV/Div 10m sec/Div

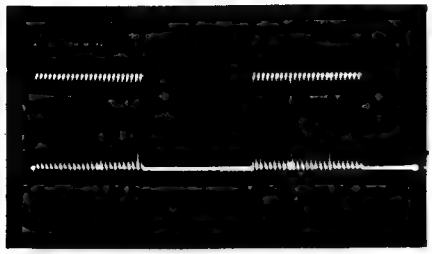
⑤ Q4E: SEARCH MODE
2V/Div 10mS/Div

⑧ IC2, 34 Pin: PLAY MODE
2V/Div 10mS/Div

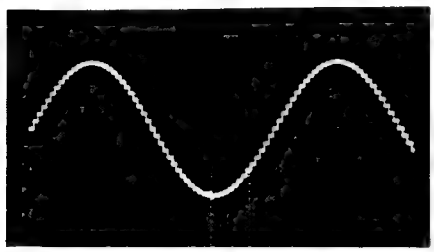


⑨ IC1 27 Pin: PLAY MODE 2V/Div 500n sec/Div 	⑫ TP2-1: PLAY MODE 2V/Div 200μS/Div 	⑯ IC3-76: STOP MODE 2V/Div 200nS/Div 
⑩ IC3-4: PLAY MODE 2V/Div 50μS/Div 	⑫ TP2-1: SEARCH MODE 2V/Div 20mS/Div 	⑰ IC3-79: STOP MODE 2V/Div 5μS/Div 
⑩ IC3-4: SEARCH MODE 2V/Div 100mS/Div 	⑬ IC2-38: PLAY MODE 2V/Div 200μS/Div 	⑱ IC3-80: STOP MODE 2V/Div 5μS/Div 
⑪ IC3-3: PLAY MODE 2V/Div 200μS/Div 	⑭ IC3-8: PLAY MODE 2V/Div 200μS/Div 	
⑪ IC3-3: SEARCH MODE 2V/Div 10mS/Div 	⑮ TP2-2: PLAY MODE 2V/Div 200μS/Div 	

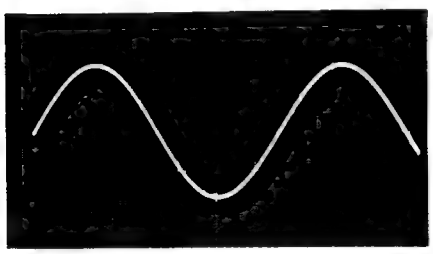
⑲ IC5-11: STOP MODE
2V/Div 1μS/Div



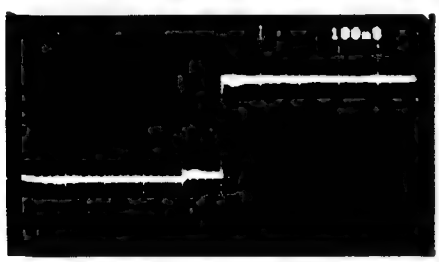
⑳ IC18-9: PLAY MODE
2V/Div 50μS/Div



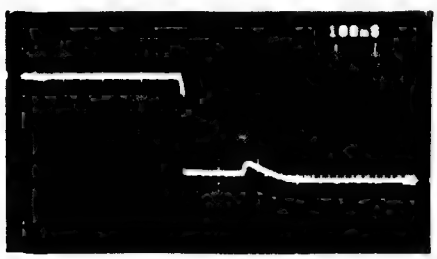
㉑ OUTPUT Lch: PLAY MODE
2V/Div 50μS/Div



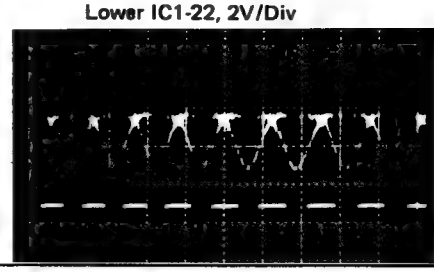
㉒ IC10-5: POWER ON
2V/Div 100mS/Div



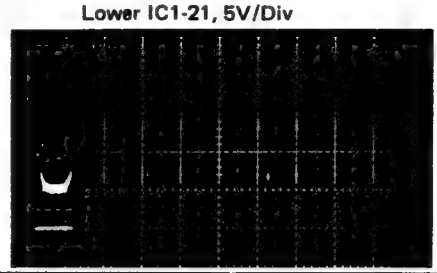
㉒ IC10-5: POWER-OFF
2V/Div 100mS/Div



㉓ IC1-22: TR OPEN
1mS/Div
Upper TP1-1, 1V/Div
Lower IC1-22, 2V/Div

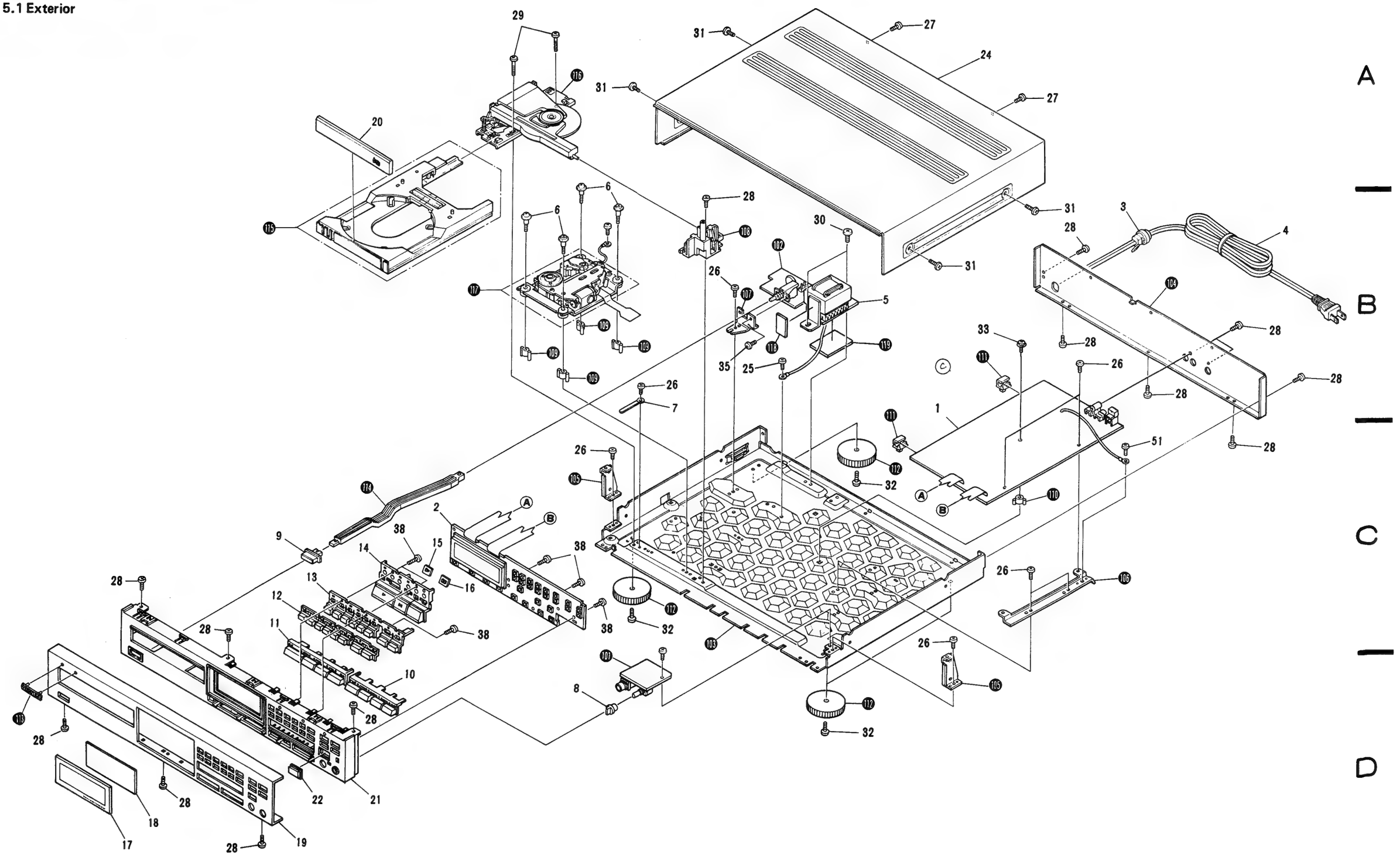


㉔ IC1-21: DFCT
1mS/Div
Upper TP1-1, 1V/Div
Lower IC1-21, 5V/Div



5. EXPLODED VIEWS AND PARTS LIST

5.1 Exterior



NOTES:

- *Parts without part number cannot be supplied.*
- *The ⚠ mark found on some component parts indicates the importance of the safety factor of the part. Therefore, when replacing, be sure to use parts of identical designation.*
- *For your parts Stock Control, the fast moving items are indicated with the marks ★★ and ★.*
  ★★ GENERALLY MOVES FASTER THAN ★
  This classification shall be adjusted by each distributor because it depends on model number, temperature, humidity, etc.
- *Parts marked by "◉" are not always kept in stock. Their delivery time may be longer than usual or they may be unavailable.*

Parts List of Exterior

Mark		No.	Part No.	Description
⚠	◉	1.	PWZ1138	Main board assembly
⚠	◉	2.	PWZ1142	Function board assembly
⚠		3.	CM-22C	Strain relief
⚠		4.	PDG1002	AC power cord
⚠	★	5.	PTT1008	Power transformer (AC120V)
		6.	PBA1001	Screw
		7.	RNH-184	Cord clamper
		8.	PAC-266	Knob (PHONES LEVEL)
		9.	PAC1058	Button (POWER)
		10.	PAC1059	Button (TRACK)
		11.	PAC1060	Button (DISPLAY)
		12.	PAC1062	Button (A) (SELECT)
		13.	PAC1063	Button (B) (SELECT)
		14.	PAC1061	Button (PLAY)
		15.	PNW1076	Lens (PLAY)
		16.	PNW1077	Lens (PAUSE)
		17.	PAM1033	Window A
		18.	PAM1035	Filter A
		19.	PAN1025	Front panel
		20.	PNW1071	Name plate A
		21.	PNW1074	Function panel(A)
		22.	PNW1075	Receiving window
		23.		.....
		24.	PNA1107	Bonnet
		25.	BBZ30P060FMC	Screw
		26.	BBZ30P060FCC	Screw
		27.	BBZ30P080FZK	Screw
		28.	BBZ30P080FCC	Screw
		29.	BBZ30P230FMC	Screw
		30.	IBZ40P080FCC	Screw
		31.	FBT40P080FZK	Screw
		32.	IBZ30P080FCC	Screw
		33.	IBZ30P150FCU	Screw
		34.		.....
		35.	PMZ30P060FMC	Screw
		36.		.....
		37.		.....
		38.	PPZ30P120FMC	Screw

Mark	No.	Part No.	Description
	101.		Headphone board assembly
	102.		Primary board assembly
	103.		Under base
	104.		Rear base
	105.		Angle
	106.		P. C. Board angle
	107.		Switch angle
	108.		Slide guide
	109.		Mechanism support
	110.		P.C.B. spacer
	111.		P. Plate holder
	112.		Foot assembly
	113.		Name plate
	114.		SW joint
	115.		Tray assembly
	116.		Loading assembly
	117.		Servo mechanism assembly
	118.		Plate A
	119.		Plate B

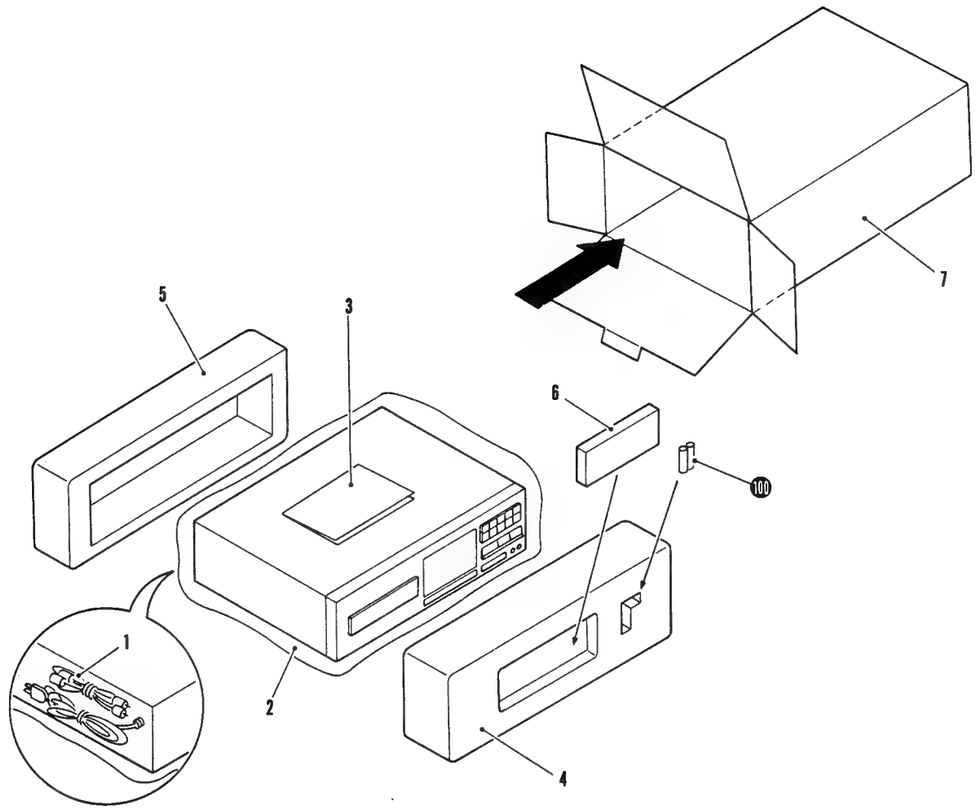
5.2 Mechanism section

Parts List of Mechanism Section

Mark	No.	Part No.	Description
	1.	PBH1013	Spring
	2.	PBP-001	Steel ball ϕ4
	3.	PNW1084	Clamp holder
	4.	PNW1085	Clamp retainer
	5.	PBH1009	Spring
	6.	PEB1031	Floating rubber
	7.	PNM1010	Disc cushion
	8.	PYY1028	Clamper assembly
	9.	CGDYX104M25	Semiconductive ceramic capacitor
	10.	PBA-209	Screw M 2x3
	11.	PBH1008	Drive spring
	12.	PBK1010	Plate spring
★★	13.	PEB1012	Belt (CARRIAGE)
	14.	PLA1003	Drive worm
	15.	PLA1004	Guide bar
	16.	PNW1062	Mechanism chassis
	17.	PNW1063	Carriage plate
	18.	PNW1064	Disc table
	19.	PNW1066	Pulley
★★	20.	PSH1003	Slide switch (INSIDE)
★★	21.	PXM1001	Spindle motor
	22.	PWY1003	Pick up assembly
★★	23.	PYY1025	Motor assembly (CARRIAGE)
	24.	PBH1011	Spring
	25.	PNW1079	Tray
	26.	PNW1183	Disc lever (F)
	27.	PNW1081	Disc lever (R)
	28.	PNW1082	Rack
	29.	PBH1012	Clamp spring

Mark	No.	Part No.	Description
★★	30.	PEB1013	Belt (LOADING)
	31.	PNW1069	Loading base
	32.	PNW1083	Clamp lever
	33.	PNW1171	Gear pulley
★★	34.	VSK-015	Leaf switch (OPEN/CLMP)
	35.	BPZ20P080FZK	Screw
	36.	PMZ20P030FMC	Screw
	37.	IPZ30P060FMC	Screw
	38.	PPZ30P080FMC	Screw
	39.	BBZ30P080FMC	Screw
	40.	BBZ30P230FMC	Screw
	41.	PBA1001	Screw
	42.		.....
	43.	PEB1032	Stopper rubber
	101.		Tray assembly
	102.		Loading base assembly
	103.		Magnet
	104.		Ballast base
	105.		Clamper
	106.		.....
	107.		.....
	108.		.....
	109.		Earth lead unit
	110.		Motor pulley
	111.		Base plate
	112.		Carriage M board
	113.		.....
	114.		Motor (CARRIAGE, LOADING)
	115.		Slide base
	116.		.....
	117.		Gear shaft
	118.		Slide guide

6. PACKING

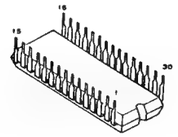


Parts List of Packing

Mark	No.	Part No.	Description
	1.	PDE1001 (PDE1002)	Connection cord
	2.	VHL-037	Sheet
	3.	PRB1015	Operating instructions (English)
	4.	PHA1013	Protector (F)
	5.	PHA1014	Protector (R)
	6.	PWW1006	Remote control unit
	7.	PHG1054	Packing case
	100.		Battery

External Appearance of Transistors and ICs

CXA1081S



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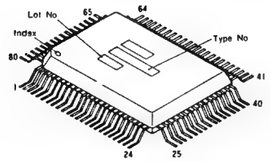

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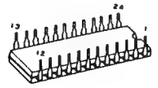
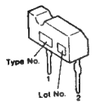


ICP-F10



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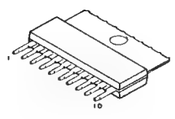

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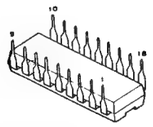

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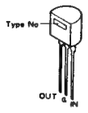

NJM78L12A

NJM79L05A
NJM79L12A

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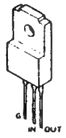

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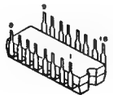

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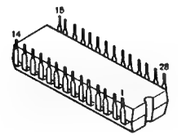

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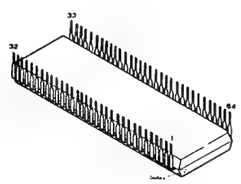

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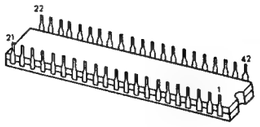

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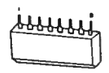

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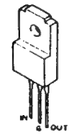

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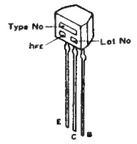

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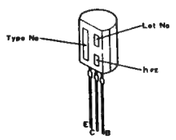
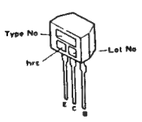
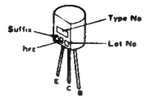


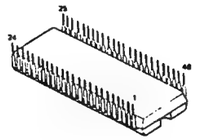
2SA933S
2SC1740S

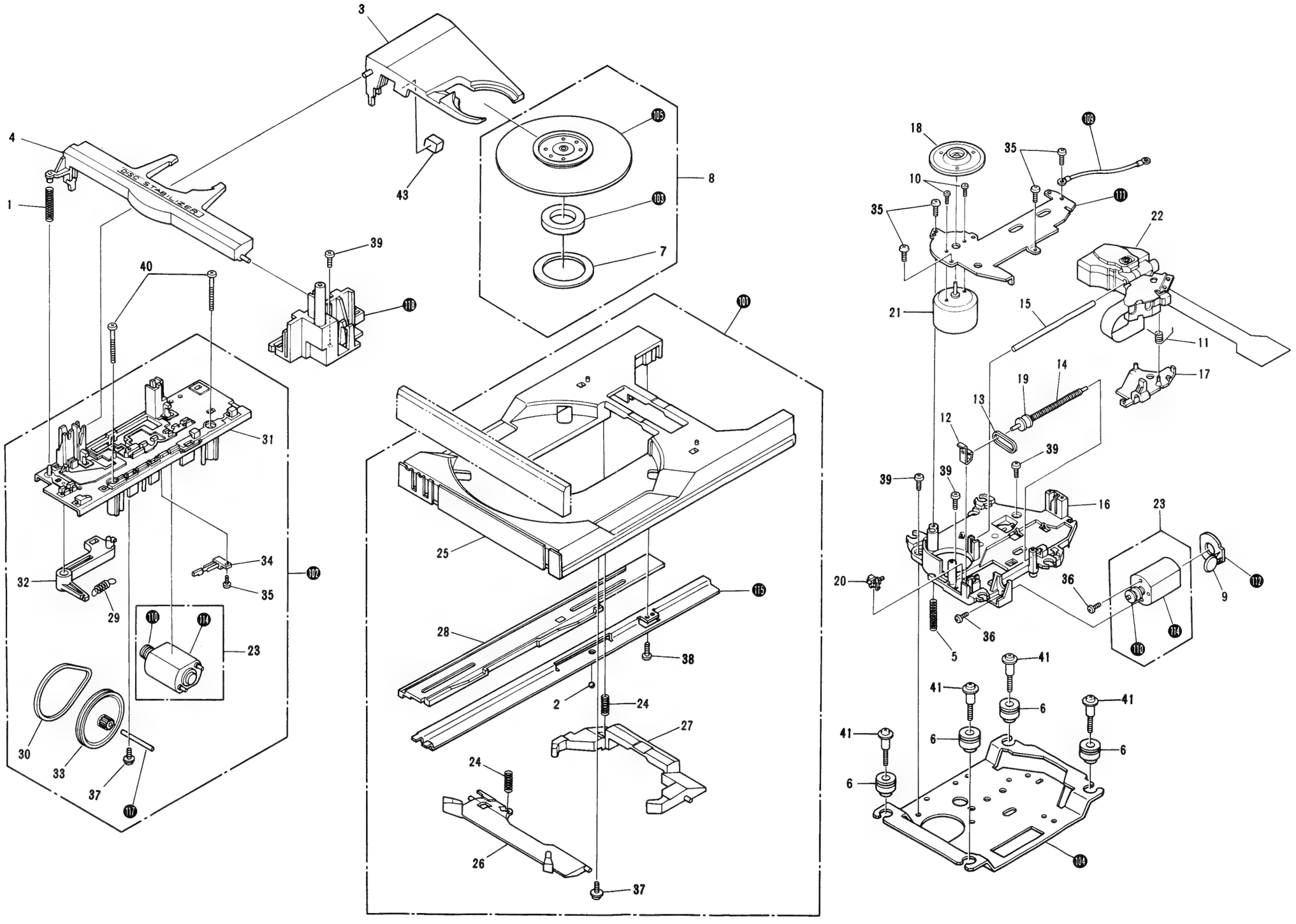


2SD1302



CXA1082AS




DISC STABILIZER
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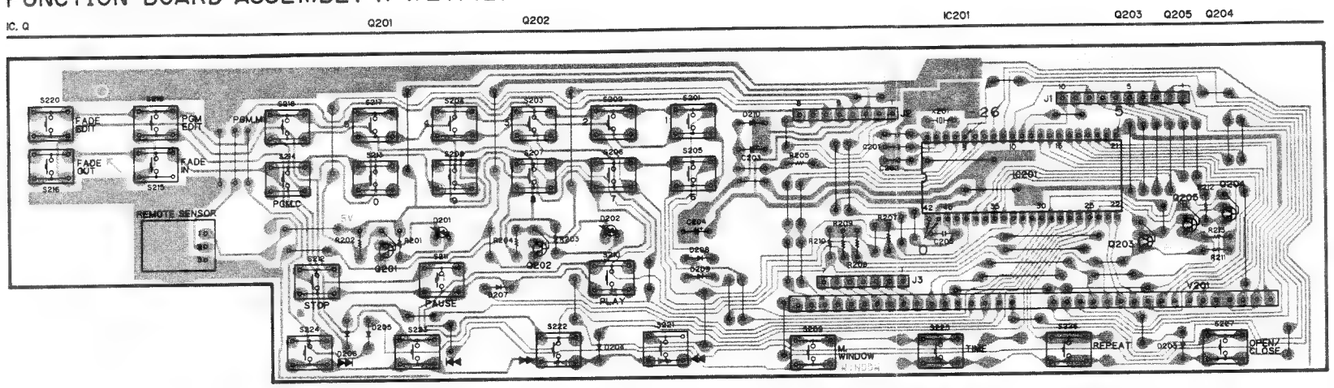
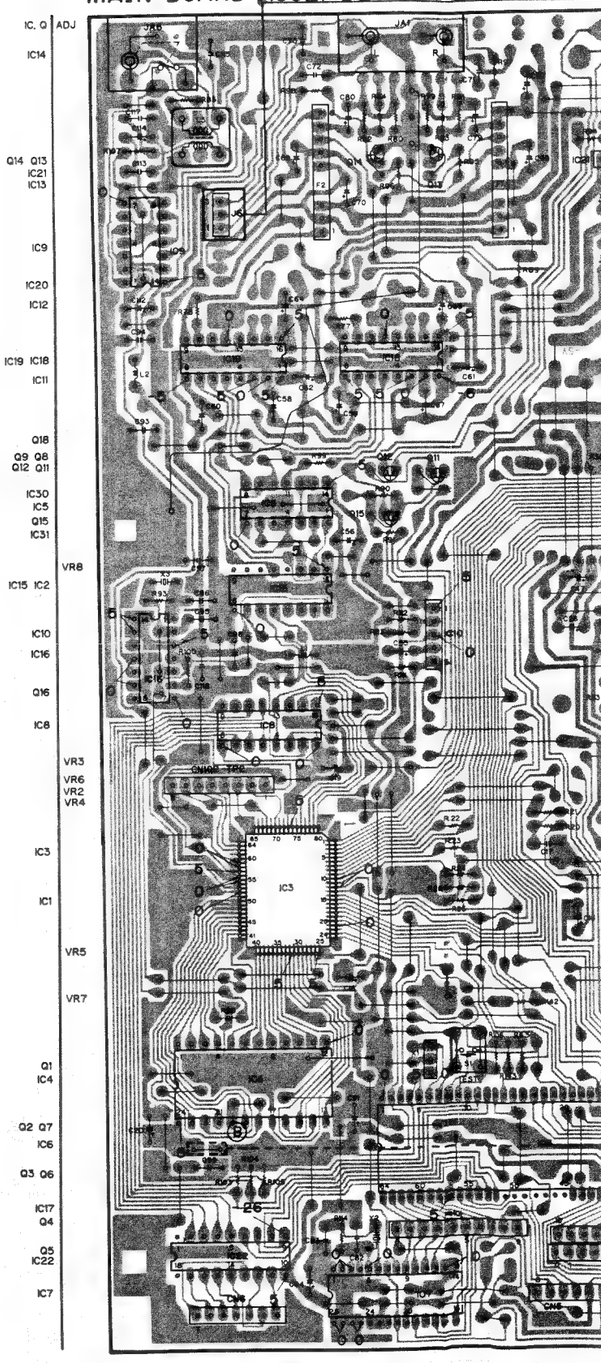
7. P.C. BOARDS CONNECTION DIAGRAM

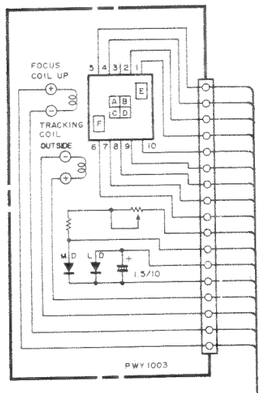
FUNCTION BOARD ASSEMBLY (PWZ1142)



MAIN BOARD ASSEMBLY (PWZ1138)



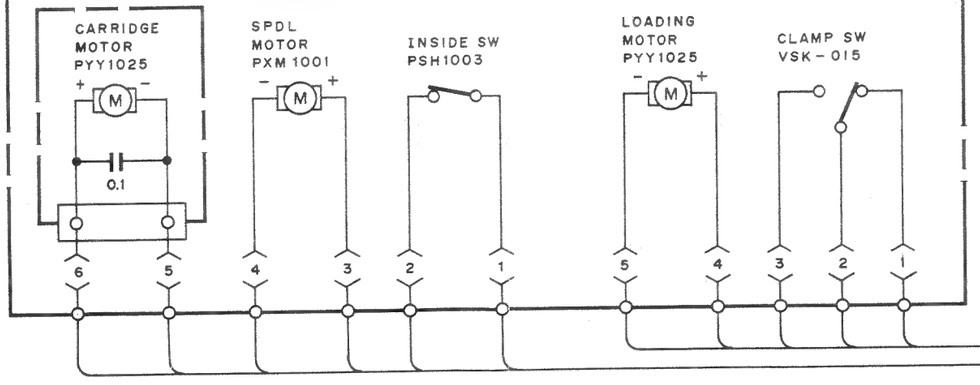
PICK UP ASSEMBLY (PWY1003)



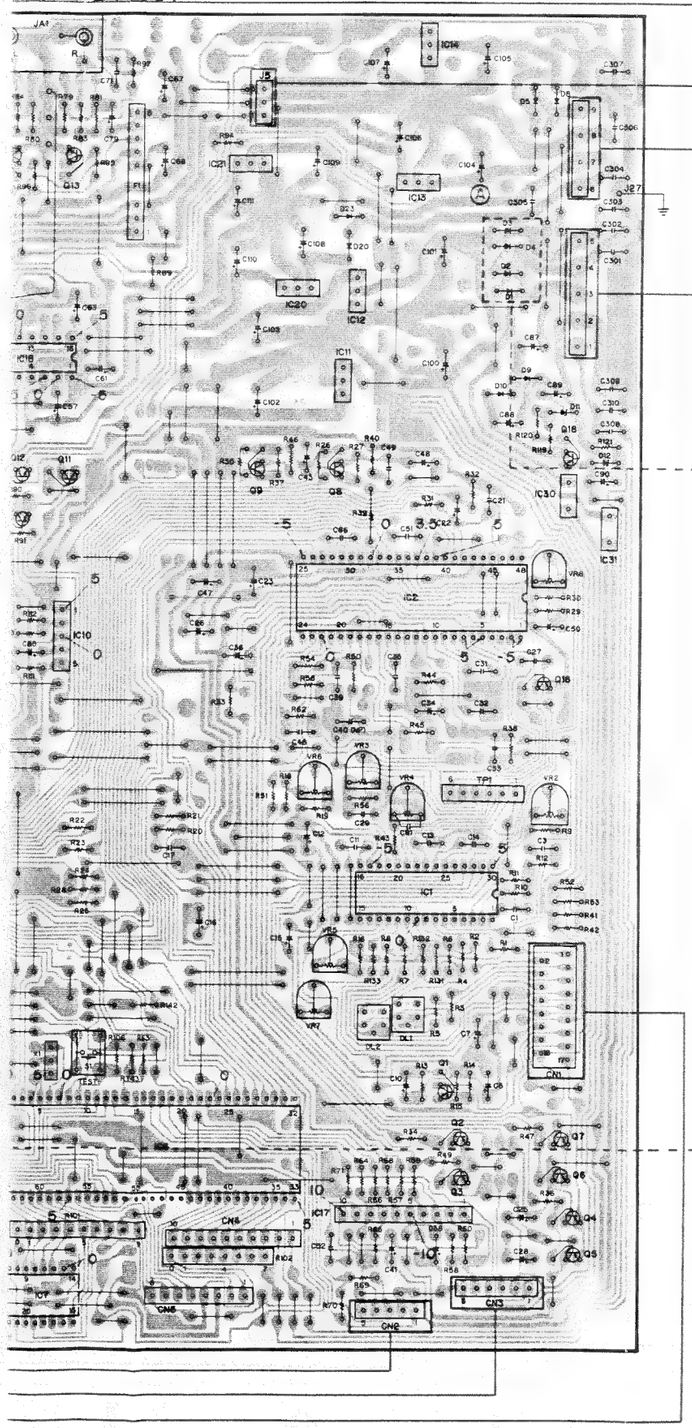
DIRECTION	CN3	
	5	6
FORWARD	+	−
REVERSE	−	+

DIRECTION	CN3	
	3	4
FORWARD	+	−
REVERSE	−	+

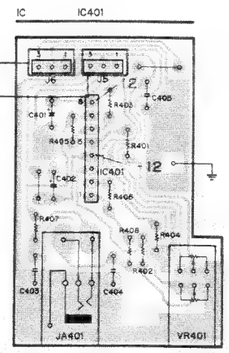
DIRECTION	CN2	
	4	5
LOADING IN	−	+
LOADING OUT	+	−



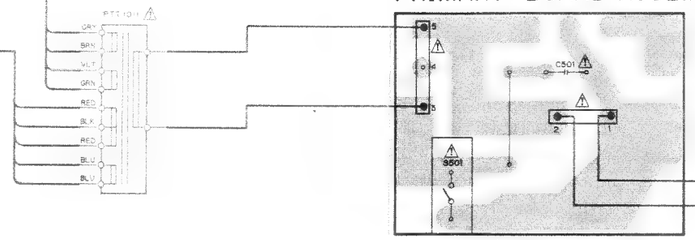
Y (PWZ1138)



HEADPHONE BOARD ASSEMBLY



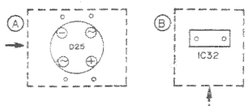
PRIMARY BOARD ASSEMBLY



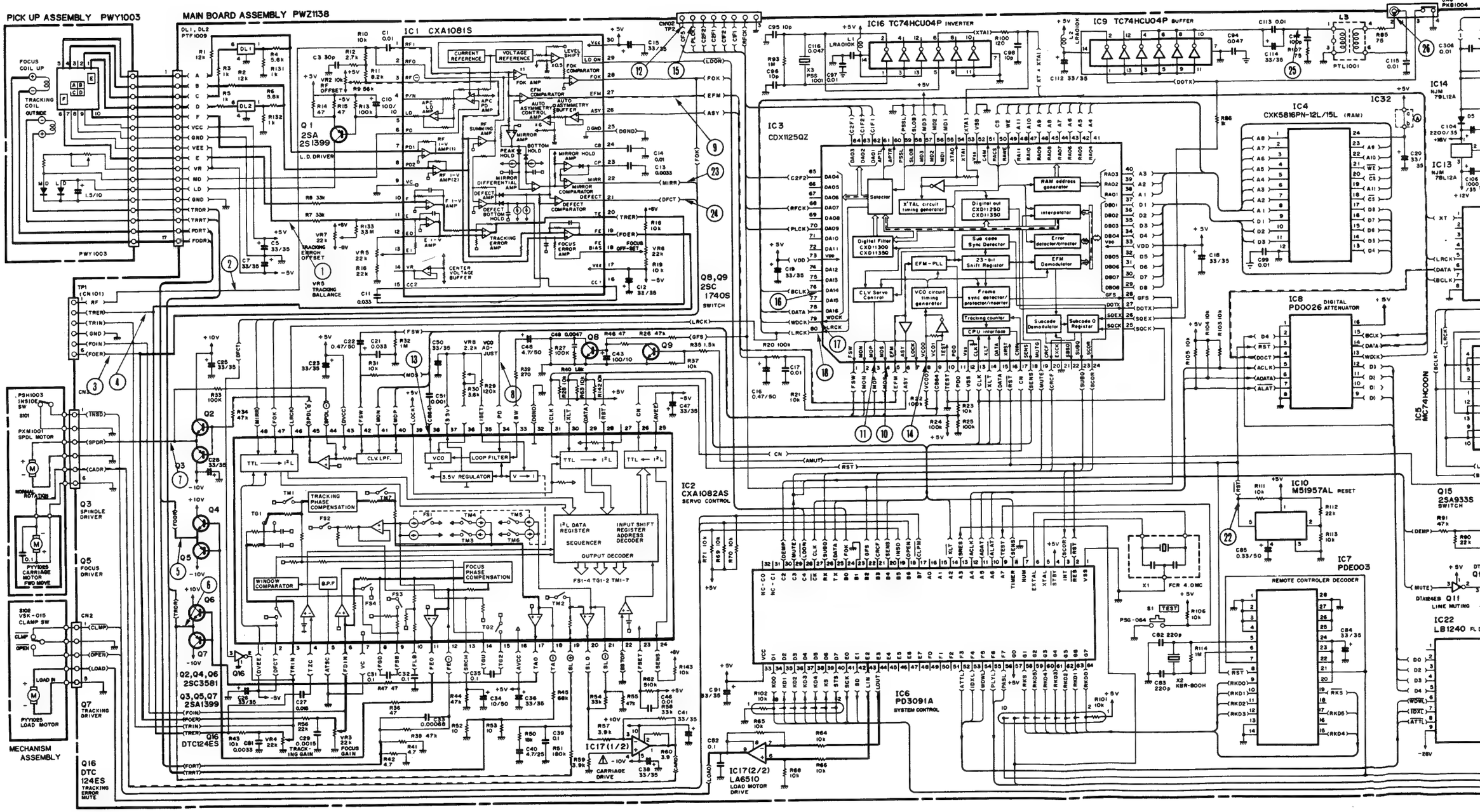
AC120V
50/60Hz ⚠

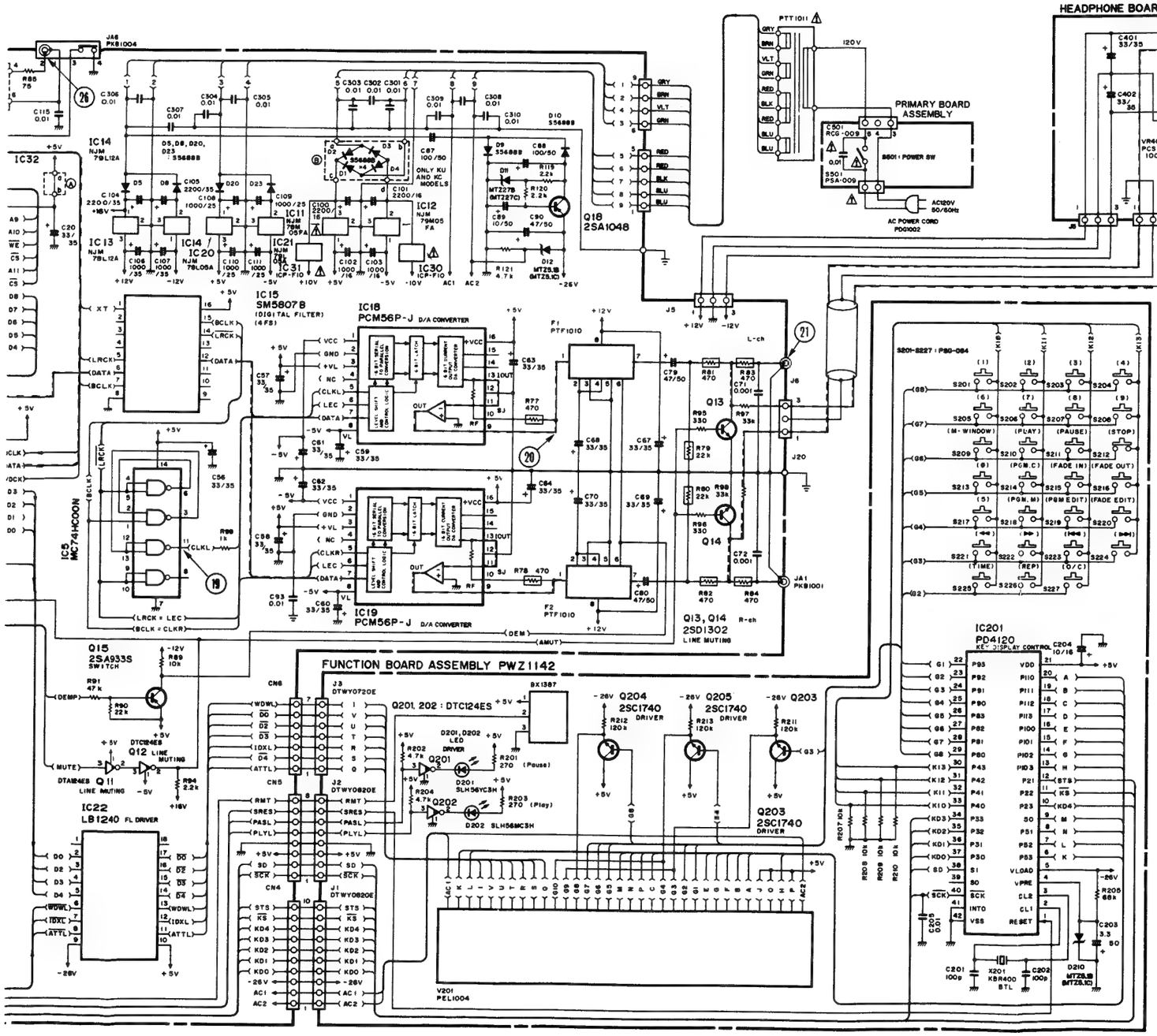
AC POWER CORD
PDG 1002

This P.C.B. pattern diagram is for KU and KC. For areas except for KU and KC, the portions enclosed by dotted lines have been cnanged as shown below.



8. SCHEMATIC DIAGRAM

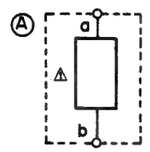




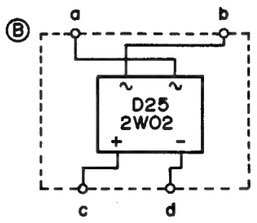
NOTE:
The indicated semiconductors are representative ones only. Other alternative semiconductors may be used and are listed in the parts list.

CIRCUIT DIAGRAM PRECAUTIONS

This circuit diagram is applicable to the KU and KC destinations. With respect to other destinations, Sections (A) and (B) of the MAIN BOARD ASSEMBLY are substituted in accordance with the figures below.



IC32 ICP-F10
IC PROTECTOR



NOTE:

1. RESISTORS:
   Indicated in Ω, 1/8W & 1/4W, ±5% tolerance unless otherwise noted k; kΩ, M; MΩ, (F); ±1%, (G); ±2%, (K); ±10%, (M); ±20% tolerance

2. CAPACITORS:
   Indicated in capacity (μF)/voltage (V) unless otherwise noted p; pF. Indication without voltage is 50V except electrolytic capacitor.

3. VOLTAGE, CURRENT:
   ; DC voltage (V) at no input signal
   Value in ( ) is DC voltage at rated power.
   mA; DC current at no input signal

4. OTHERS:
   ; Signal route.
   ; Adjusting point.

The ⚠ mark found on some component parts indicates the importance of the safety factor of the part. Therefore, when replacing, be sure to use parts of identical designation.
* marked capacitors and resistors have parts numbers.
The underlined indicates the switch position.

This is the basic schematic diagram, but the actual circuit may vary due to improvements in design.

FOCUS SERVO LOOP
TRACKING SERVO LOOP
LOADING MOTOR
SIGNAL LINE
CARRIAGE SERVO LOOP
SPINDLE SERVO LOOP

9. ELECTRICAL PARTS LIST

NOTES:

- *Parts without part number cannot be supplied.*
- *Parts marked by "◉" are not always kept in stock. Their delivery time may be longer than usual or they may be unavailable.*
- *The ⚠ mark found on some component parts indicates the importance of the safety factor of the part. Therefore, when replacing, be sure to use parts of identical designation.*
- *For your parts Stock Control, the fast moving items are indicated with the marks ★★ and ★.*
  ★★ GENERALLY MOVES FASTER THAN ★
  This classification shall be adjusted by each distributor because it depends on model number, temperature, humidity, etc.
- *When ordering resistors, first convert resistance values into code form as shown in the following examples.*

Ex. 1 When there are 2 effective digits (any digit apart from 0), such as 560 ohm and 47k ohm (tolerance is shown by J = 5%, and K = 10%).

560Ω	*56 × 10¹*	*561*	*RD1/4PS 5 6 1 J*
47kΩ	*47 × 10³*	*473*	*RD1/4PS 4 7 3 J*
0.5Ω	*0R5*		*RN2H 0 R 5 K*
1Ω	*010*		*RS1P 0 1 0 K*

Ex. 2 When there are 3 effective digits (such as in high precision metal film resistors).

5.62kΩ	*562 × 10¹*	*5621*	*RN1/4SR 5 6 2 1 F*

Miscellaneous Parts

P.C. BOARD ASSEMBLIES

Mark	Symbol & Description	Part No.
⚠ ◉	Main board assembly	PWZ1138
◉	Function board assembly	PWZ1142
	Headphone board assembly	
⚠	Primary board assembly	

OTHERS

Mark	Symbol & Description	Part No.
⚠	Strain relief	CM-22C
⚠	AC power cord	PDG1002
⚠	Power transformer (AC120V)	PTT1008
★★	Slide switch (INSIDE)	PSH1003
★★	Leaf switch (OPEN/CLMP)	VSK-015
★★	Spindle motor	PXM1001
★★	Motor assembly (CARRIAGE, LOADING)	PYY1025
	Pick up assembly	PWY1003

Headphone Board Assembly

SEMICONDUCTOR

Mark	Symbol & Description	Part No.
★★	IC401	M5218L

CAPACITORS

Mark	Symbol & Description	Part No.
	C401, C402	CEAS330M35
	C403, C404	CKCYF103Z50
	C405	CKCYF473Z50

RESISTORS

Mark	Symbol & Description		Part No.
★	VR401	Variable resistor (PHONES LEVEL)	PCS1001
	R401–R408		RD1/6PM□□□J

OTHERS

Mark	Symbol & Description		Part No.
	JA401	Phone jack	RKN1001

⚠Primary Board Assembly

SWITCH

Mark	Symbol & Description		Part No.
⚠ ★★	S501	Power switch	PSA-109

CAPACITOR

Mark	Symbol & Description		Part No.
⚠	C501	(0.01μF)	RCG009

⊙ Function Board Assembly (PWZ1142)

SEMICONDUCTORS

Mark	Symbol & Description	Part No.
★★	IC201	PD4120
★★	Q201, Q202	DTC124ES
★★	Q203–Q205	2SC1740S
★	D210	MTZ5.1B (MTZ5.1C)
★	D202	SLH-56MC3H
★	D201	SLH-56YC3HYL
★	D203–D209	1SS254

SWITCHES

Mark	Symbol & Description		Part No.
★★	S201–S227	Tact switch (OPERATION)	PSG-064

CAPACITORS

Mark	Symbol & Description	Part No.
	C204	CEAL100M16
	C203	CEAL3R3M50
	C201, C202	CKPUYB101K50
	C205	CKPUYF103Z25

RESISTORS

Mark	Symbol & Description	Part No.
	R201–R205, R207–R213	RD1/6PM□□□J

OTHERS

Mark	Symbol & Description		Part No.
★	V201	Fluorescent tube	PEL1004
		Remote-control sensor unit	BX-1387
★	X201	Ceramic resonator	KBR-400BTL

⚠ ⊙ Main Board Assembly (PWZ1138)

SEMICONDUCTORS

Mark	Symbol & Description	Part No.
★★	IC1	CXA1081S
★★	IC2	CXA1082AS
★★	IC3	CXD1125QZ
★★	IC4	CXK5816PN-12L (CXK5816PN-15L)
⚠ ★★	IC30, IC31	ICP-F10
★★	IC17	LA6510
★★	IC22	LB1240
★★	IC5	MC74HC00N
★★	IC10	M51957AL
★★	IC20	NJM78L05A
★★	IC13	NJM78L12A
⚠ ★★	IC11	NJM78M05FA
★★	IC21	NJM79L05A
★★	IC14	NJM79L12A
★★	IC12	NJM79M05FA
★★	IC15	SM5807B
★★	IC18, IC19	PCM56P-J
★★	IC7	PDE003
★★	IC8	PD0026
★★	IC6	PD3091A
★★	IC9, IC16	TC74HCU04P
★★	Q11	DTA124ES
★★	Q12, Q16	DTC124ES
★★	Q18	2SA1048
★★	Q1, Q3, Q5, Q7	2SA1399
★★	Q15	2SA933S
★★	Q8, Q9	2SC1740S
★★	Q2, Q4, Q6	2SC3581
★★	Q13, Q14	2SD1302
★	D11	MTZ27B (MTZ27C)
★	D12	MTZ5.1B (MTZ5.1C)
★	D1–D5, D8–D10, D20, D23	S5688B

SWITCH

Mark	Symbol & Description		Part No.
★★	S1	Tact switch (TEST)	PSG-064

COILS AND FILTERS

Mark	Symbol & Description		Part No.
	L2		LRA010K
	L3		PTL1001
	F1, F2	Low-pass filter (30k)	PTF1010

CAPACITORS

Mark	Symbol & Description	Part No.
	C3	CCCCH300J50
	C95, C96	CCCCH100D50
	C82, C83	CCCSL221J50
	C40	CEANP4R7M25
	C85	CEAR33M50
	C16, C22	CEAR47M50
	C34, C89	CEAS100M50
	C43	CEAS101M10
	C87, C88	CEAS101M50
	C102, C103	CEAS102M16
	C108, C109	CEAS102M25
	C106, C107	CEAS102M35
	C89	CEAS220M50
	C100, C101	CEAS222M16
	C104, C105	CEAS222M35
	C5, C7, C12, C15, C18–C20, C23, C25, C26, C28, C36, C38, C41, C47, C50, C56–C64, C67–C70, C112, C114, C91	CEAS330M35
	C84	CEAS330M35
	C79, C80, C90	CEAS470M50
	C110, C111	CEAS471M25
	C10	CEA101M10
	C48	CEA4R7M50
	C113, C301–C310, C93, C97, C115	CKCYF103Z50
	C52	CGCYX104M25
	C71, C72	CQSA102J50
	C94, C86, C116	CKCYF473Z50
	C51	CQMA102K50
	C1, C17, C46, C14	CQMA103K50
	C31, C32, C39, C35	CQMA104K50
	C29	CQMA152J50
	C21, C11	CQMA333K50
	C49	CQMA472K50
	C81, C13	CQMA332J50
	C33	CQMA681K50
	C27	CQMA153K50

RESISTORS

Mark	Symbol & Description		Part No.
★	VR3, VR4, VR5, VR6, VR7	Semi-fixed resistor (22k)	VRTB6VS223
★	VR8	Semi-fixed resistor (2.2k)	VRTS6VS222
★	VR2	Semi-fixed resistor (10k)	VRTB6VS103
	R102	Resistor array	RA7S103J
	R101	Resistor array	RA9S103J
	R30	Metal film resistor	RN1/6PQ3601F
	R77–R84		RDF1/4PU□□□J
		Other resistors	RD1/6PM□□□J

OTHERS

Mark	Symbol & Description		Part No.
	JA1	2P terminal	PKB1006
	JA6	1P terminal	PKB1004
★	X1	Ceramic oscillator (4.0MHz)	FCR4.0MC
★	X2	Ceramic resonator	KBR-800H
★	X3	Crystal resonator	PSS1001
	DL1, DL2	Delay line	PTF1009

10. ADJUSTMENTS

The adjustments for this unit are given below. Adjustments must be made in the order in which they are listed.

● ADJUSTMENTS

1. Tracking error offset, focus offset and RF offset adjustment
2. LD (laser diode) power check
3. Focus lock and spindle lock check
4. Grating adjustment
5. Tracking balance adjustment
6. Tangential adjustment
7. RF level check
8. Focus gain adjustment
9. Tracking gain adjustment
10. VCO free run frequency adjustment

● REQUIRED EQUIPMENT

1. Dual trace oscilloscope
2. Optical power meter
3. Test disc (YEDS-7)
4. Loop gain adjustment filter
5. Signal generatorr
6. Frequency counter
7. Other regular measuring equipment

● ABOUT THE TEST MODE

All adjustments must be carried out with the unit in the test mode.

How to activate and release the test mode

① To activate the test mode, turn ON the power switch (S501) with the test mode switch (S1) in the ON position.

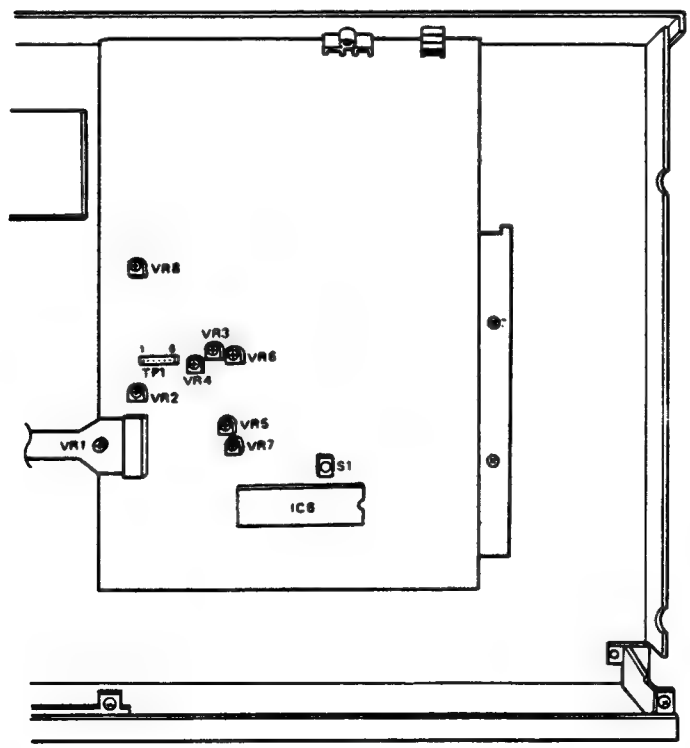
② The test mode is released by turning the power switch OFF.

The functions of the keys in the test mode are outlined in Table 10-1.

● ADJUSTMENT VRs AND THEIR NAMES

VR1: Laser power
VR2: RF offset (RF.OFS)
VR3: Focus gain (FCS.GAN)
VR4: Tracking gain (TRK.GAN)
VR5: Tracking balance (TRK.BAL)
VR6: Focus offset (FCS.OFS)
VR7: Tracking offset (TRK.OFS)
VR8: VCO adjust (VCO.ADJ)

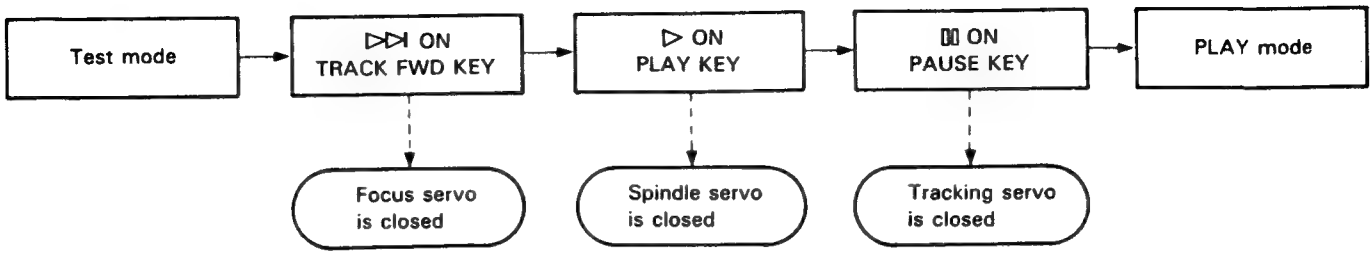
Adjustment Point



In the test mode, the servos must be closed and opened individually. Consequently, the servos must each be closed in the proper sequence (serial sequence) in order to put the machine into the play mode. Note also that the machine will not enter the play mode when the PAUSE (▯▯) key is pressed.

For example, in order to change from the stop to the play mode, the function keys must be pressed in the following order:

* In the test mode, the servos must be operated in serial sequence.



● KEY FUNCTIONS IN THE TEST MODE

Symbol	Key name	Function in test mode	Description
▷▷I	TRACK FWD	Focus servo close	Turns ON the laser diode, and raises and lowers the focusing actuator to close the focus servo.
▷	PLAY	Spindle servo close	Closes the servo in the CLV-A mode after kicking the spindle motor.
▯▯	PAUSE	Tracking servo close/open	Acts as a toggle: closes the tracking servo and activates play mode when pressed (provided the focus and spindle servos are closed), at which time the PAUSE indicator illuminates; opens the tracking servo when pressed again.
◁◁	MANUAL SEARCH REV	Carriage reverse (moves inward)	Moves carriage quickly (3cm/s) toward innermost track. Be careful not to move too far as there is no safety device to stop the carriage.
▷▷	MANUAL SEARCH FWD	Carriage forward (moves outward)	Moves carriage quickly (3cm/s) toward outermost track. Be careful not to move too far as there is no safety device to stop the carriage.
□	STOP	Stop	Stops all servos and returns system to its initial state.
⏏	OPER/CLOSE	Disc tray open/close	Opens and closes the disc tray. However, pickup does not return to rest on OPEN, and it remains stationary on CLOSE.

Table 10-1.

Step No.	Oscilloscope Setting V	Oscilloscope Setting H	Test Points	Adjusting Points	Check items/ Adjustment specifications	Adjustment procedure
1	**Tracking error offset, focus offset and RF offset adjustment**					
			TP1 Pin 2 (TRK. ERR)	VR5 (TRK. BAL) VR7 (TRK. OFS)	Tracking error offset 45° 0V±50mV	● Put unit in the test mode (see page 36). ● Set VR5 TRK.BAL (tracking balance) to the position about 45° to the left of center. ● Adjust VR7 TRK.OFS(tracking offset) so that the TRK.ERR (tracking error) voltage at TP1 pin 2 becomes 0V ± 50mV.
			TP1 Pin 6 (FCS. ERR)	VR6 (FCS.OFS)	Focus offset 0V ± 50mV	● Adjust VR6 FCS.OFS (focus offset) so that the FCS.ERR (focus error) voltage at TP1 pin 6 becomes 0V ± 50mV.
			TP1 Pin 1 (RF. OUTPUT)	VR2 (RF.OFS)	RF offset 100mV ± 50mV	● Adjust VR2 RF.OFS (RF offset) so that the RF output voltage at TP1 pin 1 becomes 100mV ± 50mV. Note: When adjusting the tracking error offset, always perform "5. Tracking Balance Adjustment."
2	**LD (laser diode) power check**					
				VR1	Specification: 0.13mW ± 0.01mW	● Put unit in the test mode (see page 36). ● Press the TRACK FWD (▷▷|) key to turn ON the laser diode. ● Place the sensor of the optical power meter directly above the objective lens and confirm that LD power is 0.13mW ± 0.01mW. ● If the reading is not conforms specification, adjust VR1 (LD power adjust) so that the laser diode power conforms to specification.
3	**Focus lock and spindle lock check**					
	V 0.5V/div	H 100msec/ div	TP1 pin1 (RF output)		RF signal is output Forward (clockwise) rotation	● Set the test disc. ● Put unit in the test mode (see page 36). ● Press the MANUAL SEARCH FWD (▷▷) key to move the pickup to the center of the disc. ● Observe the output of TP1 pin 1 (RF output) on the oscilloscope. Confirm that the RF signal is output after the TRACK FWD (▷▷|) key is pressed. ● Press the PLAY (▷) key and confirm that the disc rotates at constant speed (approx. 30 rpm near center of disc) in the forward (clockwise) direction; disc may not run away or rotate counterclockwise.

Step No.	Oscilloscope Setting V	Oscilloscope Setting H	Test Points	Adjusting Points	Check items/ Adjustment specifications	Adjustment procedure
4	Grating adjustment (1)					

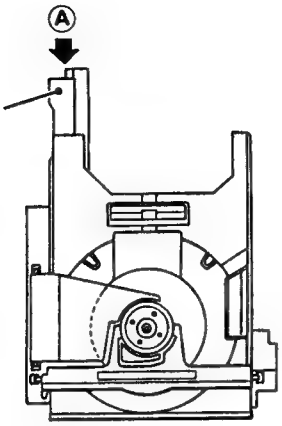


Fig. 10-1

Remove the disc tray before beginning this adjustment.

● Removal of the disc tray

1. Press the rear edge of the rack, marked Ⓐ in Fig. 10-1, while pulling the disc tray out to the position where it catches, illustrated in Fig. 10-2.

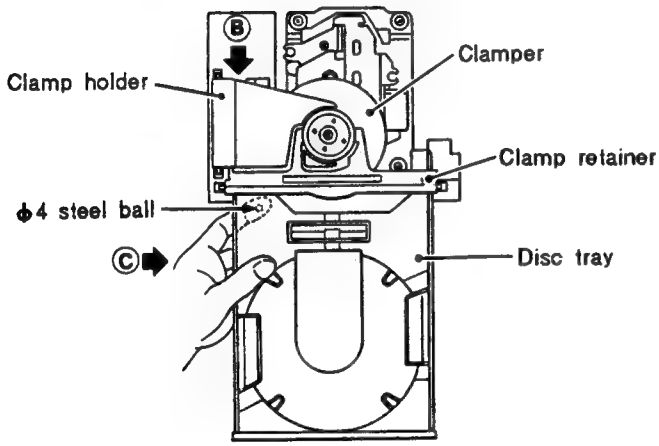


Fig. 10-2

2. While pulling the clamp holder Ⓑ (see Fig. 10-2) upward with the right hand, hold the tray as indicated by Ⓒ in the left hand and pull it outward. Take care not to allow the ϕ4 steel ball to fall (we recommend holding the ball in place with the left index finger while extracting the tray).

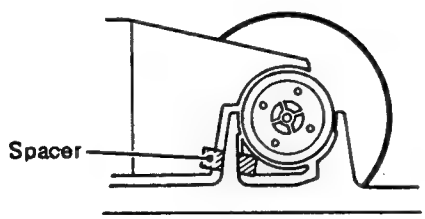


Fig. 10-3

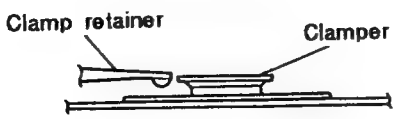


Fig. 10-4

Step No.	Oscilloscope Setting V	Oscilloscope Setting H	Test Points	Adjusting Points	Check items/ Adjustment specifications	Adjustment procedure
						● Put unit in the test mode (see page 36). ● Press the MANUAL SEARCH FWD (▷▷) key to move the pickup to the vicinity of what would be the center of the disc. Position the pickup so its grating adjusting screw is visible through the elongated hole on the spindle motor side of the servo mechanism base plate. ● As shown in Fig. 10-5, insert a (slotted) screwdriver from the rear of the mechanism and check that the grating adjusting screw can be rotated. ● Mount the test disc; be sure to insert a 3 — 5 mm spacer (if no spacer is available, use a hex wrench) between the clamp holder and clamp retainer, as shown in Fig. 10-3. ● Confirm that the clamper and the clamp retainer are not contacting one another (Fig. 10-4). ● Press the TRACK FWD (▷▷|) and the PLAY (▷) keys sequentially to close the focus and spindle servos (do not close the tracking servo). ● Insert a 4kHz-cutoff low pass filter between the oscilloscope and TP1 pins 2 (TRK.ERR) and 4 (GND) as shown in Fig. 10-6 and observe the waveform of TP1 pin 2 (tracking error) on the oscilloscope.
	0.5V/div	5ms/div	TP1 Pin 2 TRK. ERR	Grating adjusting screw	Null point	● Turn the grating adjusting screw with the ⊖ screwdriver to find the null point (see Photo 10-1).
				Grating adjusting screw	Max. amplitude	● Next, slowly rotate the screw clockwise and adjust to the point where the waveform (tracking error signal) first achieves its maximum amplitude (see Photo 10-3).
						Note: Avoid applying pressure to the ⊖ screwdriver while adjusting the screw. Doing so causes the pickup to move inward, making adjustment more difficult.
						● Lastly, remove the low pass filter and confirm that the tracking error signal p-p voltage does not greatly vary when the pickup is moved to the inner-most and outer-most tracks of the disc. If the levels diverge by ±10% or more, re-adjust the maximum error amplitude point by rotating the grating adjusting screw.

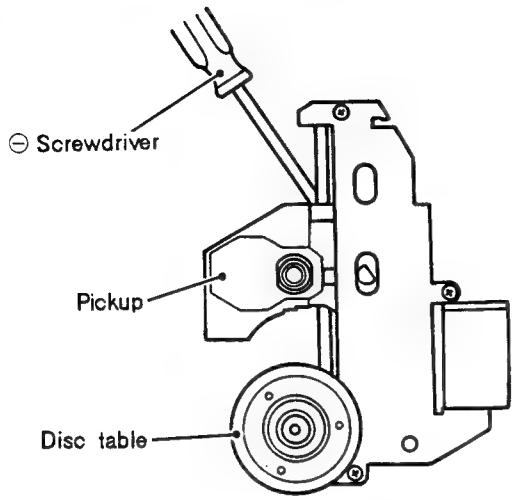


Fig.10-5

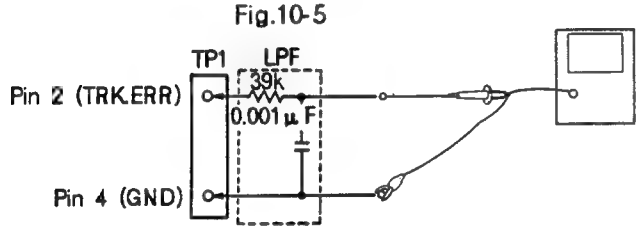


Fig. 10-6

Step No.	Oscilloscope Setting V	Oscilloscope Setting H	Test Points	Adjusting Points	Check items/ Adjustment specifications	Adjustment procedure
						Re-mount the disc tray according to the following procedure when the grating adjustment is complete. 1. Remove the disc and the spacer. 2. While lifting the clamp holder [marked Ⓑ in Fig. 10-2] with the right hand, hold the tray in the left hand as indicated by Ⓒ and slide the slide base into the hard resin fittings on the loading base as shown in Fig. 10-7 to re-insert the disc tray. At this time, be sure to hold the steel ball in place with the index finger of the left hand. Also, be careful that the front panel is not damaged by the slide base and bearing of the steel ball's bearing (in the slide base) coming into contact with the panel. 3. Insert the slide base so that it fits into the two hard resin fittings at the rear of the loading base (see Fig. 10-8). 4. Insert the tray all the way.

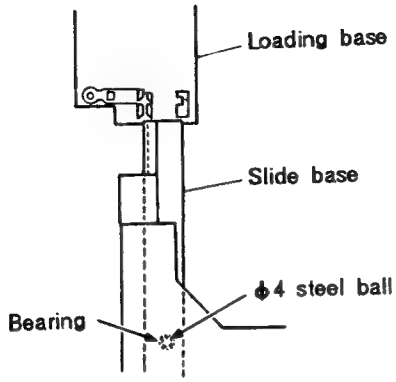


Fig. 10-7

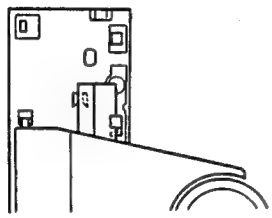


Fig. 10-8

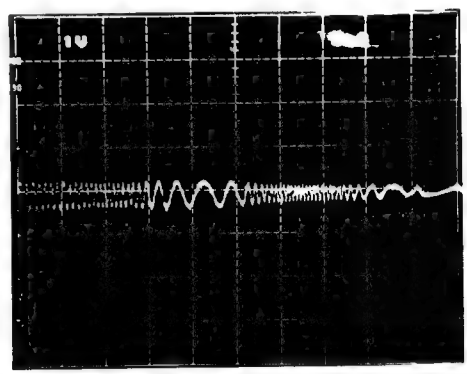


Photo 10-1 Null point

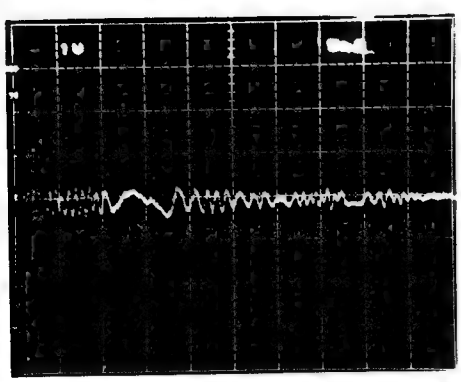


Photo 10-2 This is not the null-point waveform.

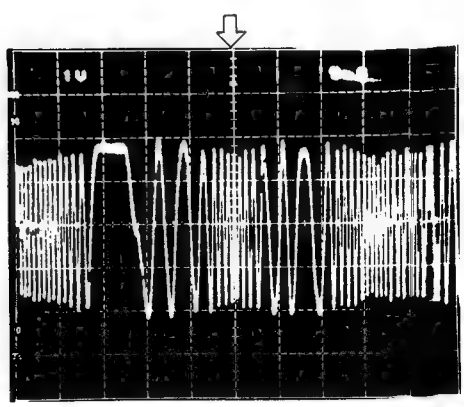


Photo 10-3 Maximum amplitude

Step No.	Oscilloscope Setting V	Oscilloscope Setting H	Test Points	Adjusting Points	Check items/ Adjustment specifications	Adjustment procedure
4	**Grating Adjustment (2) (using discs with a recording time of 60 min. or more)**					
	0.5V/div	5ms/div	TP1 Pin 2 (TRK.ERR)	Grating	Null point	● Insert a ⊖ screwdriver into the grating hole, turn and find the null point (see Photo 10-1).
				Grating	Maximum amplitude	● Next, slowly turn the screwdriver clockwise from the null point and adjust until the waveform (tracking error signal) reaches maximum amplitude (see Photo 10-3).

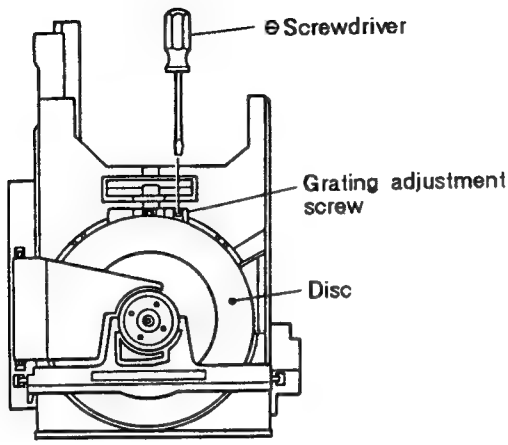


Fig.10-9

Note: This adjustment can only be performed with a disc having pits up to R115mm, not with the Test Disc (YEDS-7).

- Put unit in the test mode (see page 36).
- Load the test disc, shift the pickup to the outer periphery so that the pickup grating adjustment hole is visible from the pit surface of the disc or from the hole in the servo mechanism (see Fig. 10-9).
- Press the TRACK FWD key (▷▷|) and PLAY key (▷) in sequence to turn on the focus servo and spindle servo (do not turn on the tracking servo).
- Observe the TRK.ERR (tracking error) waveform at TP1 pin 2 on an oscilloscope, inserting a 4kHz low-pass filter (see Fig. 10-10).

Note: Use caution since inserting the ⊖ screwdriver forcefully will cause the pickup unit to float upward.

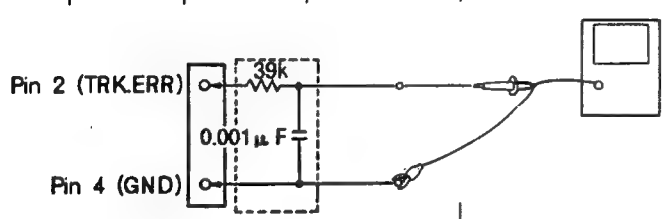


Fig.10-10

- Finally, make sure that there is no major fluctuation in the p-p voltage of the tracking error signal (do not insert the cutoff 4kHz low-pass filter) when the pickup is shifted to the inner periphery and when the pickup is shifted to the outer periphery. If there is a difference of more than ±10% again rotate the grating adjustment screw and adjust the tracking error signal to maximum.

Step No.	Oscilloscope Setting V	Oscilloscope Setting H	Test Points	Adjusting Points	Check items/ Adjustment specifications	Adjustment procedure
5	**Tracking balance adjustment**					
	0.5V/div	5ms/div	TP1 Pin 2 (TRK. ERR)	VR5 (TRK.BAL)		● Load the test disc. ● Put unit in the test mode (see page 36). ● Press the MANUAL SEARCH FWD (▷▷) key to position the pickup near the center of the disc. ● Press the TRACK FWD (▷▷|) and PLAY (▷) keys sequentially to cause the disc to rotate. ● Observe TP1 pin 2 TRK.ERR (tracking error) on the oscilloscope and adjust VR5 TRK.BAL(tracking balance) to eliminate the DC elements from the tracking error signal.
6	**Tangential adjustment**					

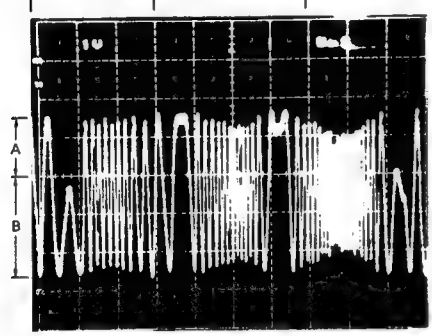


Photo 10-4 DC elements mixed in signal

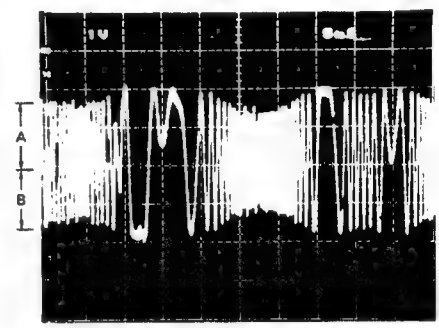
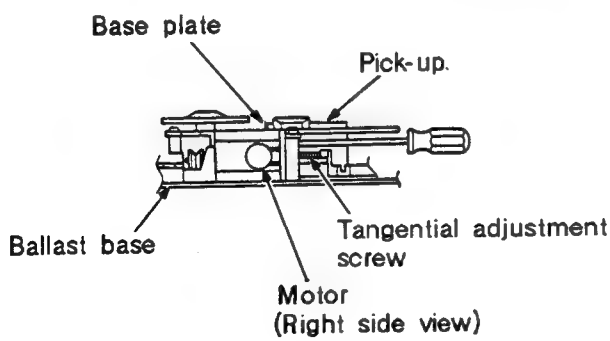


Photo 10-5 DC elements eliminated



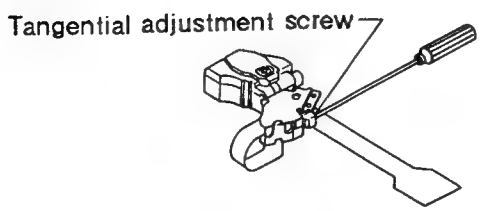
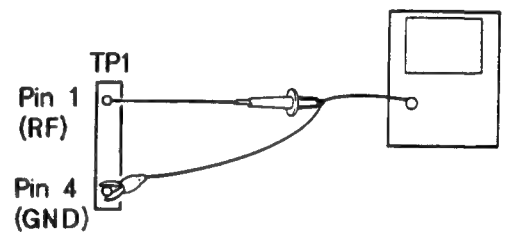


Fig.10-11

● Put unit in the test mode (see page 36).
● Open the tray and load the test disc.
● Press the MANUAL SEARCH FWD (▷▷) key to position the pickup near the center of the disc.
● Insert a hex wrench into the tangential adjustment screw section from the rear of the mechanism.
● Close the tray.

Note: Do not use an L-shaped hex wrench. Use one such as shown to the left. Using an L-shaped hex wrench can cause the tray to come loose (see page 39 4. Grating Adjustment (1)).

Step No.	Oscilloscope Setting V	Oscilloscope Setting H	Test Points	Adjusting Points	Check items/ Adjustment specifications	Adjustment procedure
		200ns	TP1 Pin 1 RF output	Tangential adjustment screw	Sharpest possible eye pattern	● Press the TRACK FWD (▷▷I), PLAY (▷), and PAUSE (▯▯) keys sequentially to close the all servos (pause indicator will illuminate). ● Observe TP1 pin 1 (RF output) on the oscilloscope and adjust the tangential adjustment screw to achieve the sharpest possible eye pattern. ● The point to which the adjusting screw should be set lies about halfway between the points at which the eye pattern becomes most blurred when the screw is rotated clockwise and counterclockwise. When the whole waveform becomes clear, concentrate on sharpening the fine lines forming the diamond at the center of the eye pattern (see Photo 10-8). Adjust until the fine lines on all four sides of the diamond are both sharply defined and dense, as shown in Photo 10-6.  Fig. 10-12 Note: Use a hex wrench to raise the pickup somewhat while making this adjustment.

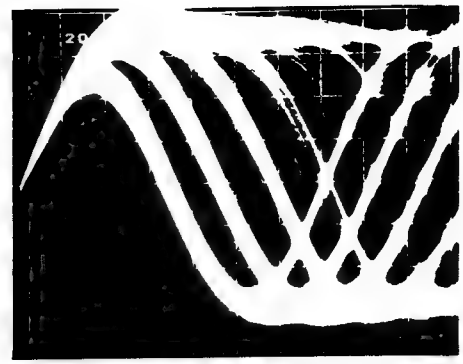


Photo 10-7

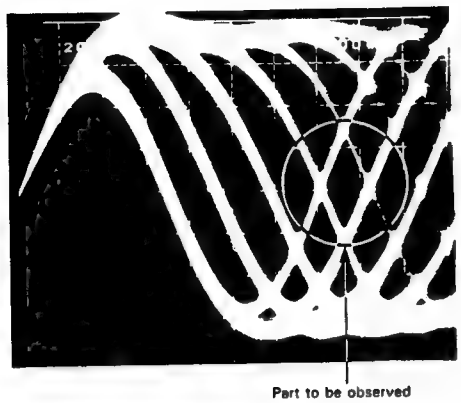


Photo 10-6

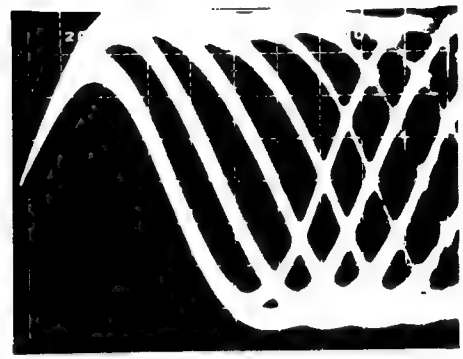


Photo 10-8

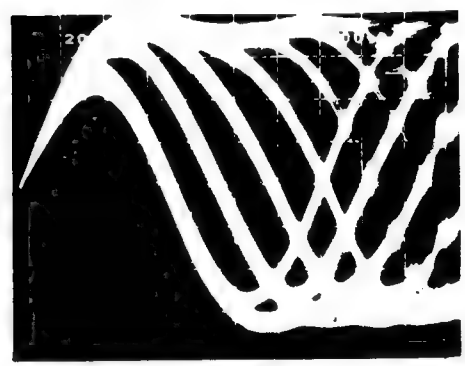


Photo 10-9

Step No.	Oscilloscope Setting V	Oscilloscope Setting H	Test Points	Adjusting Points	Check items/ Adjustment specifications	Adjustment procedure
7	**RF level check**					
				VR1 (Laser power)	2.0V ± 0.6V	● Put unit in the test mode (see page 36). ● Connect the oscilloscope to TP1 pin 1 (RF output), play the test disc, and measure the P-P voltage of the RF waveform. ● Check that voltage is 2.0V ± 0.6V. ● When 2.6V is exceeded, adjust VR1 so that 2.0V ± 0.6V is obtained.
8	**Focus gain adjustment**					
	20mV/div 5mV/div CH1(X), CH2(Y) (prove 10:1)		X-axis TP1 Pin 5 (FCS. IN) Y-axis TP1 Pin 6 (FCS. ERR)	VR3 (FCS. GAN)	Phase difference of 90°	● With the oscillator power turned OFF, connect the oscilloscope and oscillator as shown in Fig. 10-13. ● Put unit in the test mode (see page 36). ● Press the TRACK FWD (▷▷|), PLAY (▷), and PAUSE (▯▯) keys sequentially to activate the focus, spindle, and tracking servos. ● Turn ON the power to the oscillator and set it to output a 1.2kHz 1Vp-p signal. Note: Some oscillators discharge a DC voltage when turned on. It is therefore recommended that the oscillator be connected after it has been turned on. ● Adjust VR3 FCS.GAN(focus gain) so that the Lissajous's figure becomes a horizontal circle (phase difference of 90°).

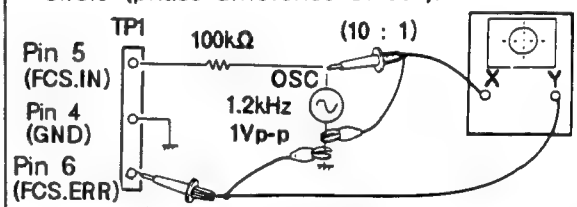
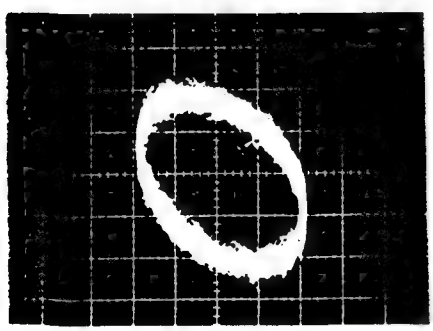
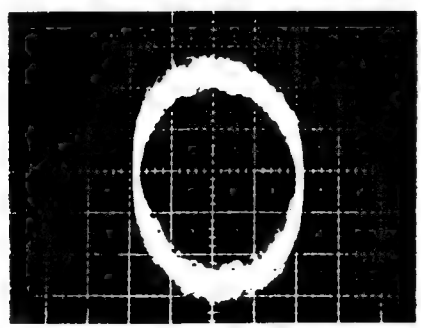
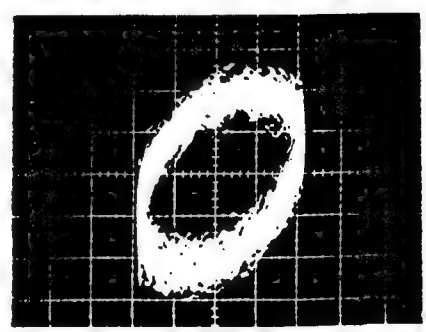


Fig. 10-13


Gain overcompensated
Photo 10-10


Gain optimal
Photo 10-11


Gain undercompensated
Photo 10-12

Step No.	Oscilloscope Setting V	Oscilloscope Setting H	Test Points	Adjusting Points	Check items/ Adjustment specifications	Adjustment procedure
9	Tracking gain adjustment					
	50mV/div 5mV/div CH1(X), CH2(Y) (prove 10:1)		X-axis TP1 Pin 3 (TRK. IN) Y-axis TP1 Pin 2 (TRK. OUT)	VR4 (TRK.GAN)	Phase difference of 90°	● With the oscillator power turned OFF, connect the oscilloscope and oscillator as shown in Fig. 10-14. ● Put unit in the test mode (see page 36). ● Press the TRACK FWD (▷▷|), PLAY (▷), and PAUSE (▯▯) keys sequentially to activate the focus, spindle, and tracking servos. ● Turn ON the power to the oscillator and set it to output a 1.2kHz 2Vp-p signal. Note: Some oscillators discharge a DC voltage when turned on. It is therefore recommended that the oscillator be connected after it has been turned on. ● Adjust VR4 TRK.GAN (tracking gain) so that the Lissajous's figure becomes a horizontal circle (phase difference of 90°).

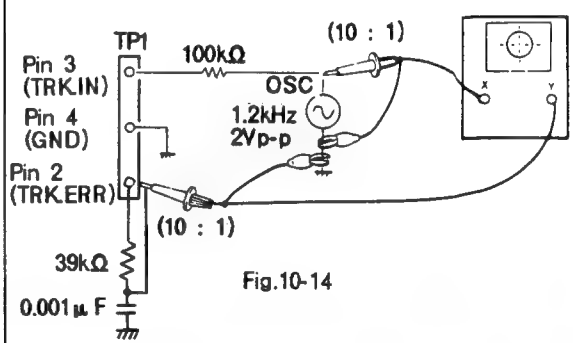
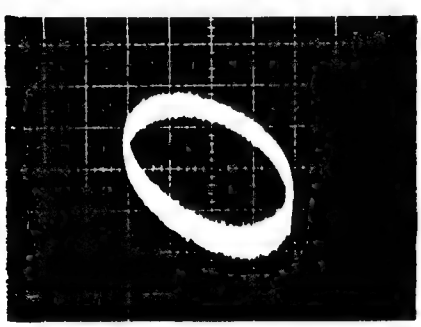
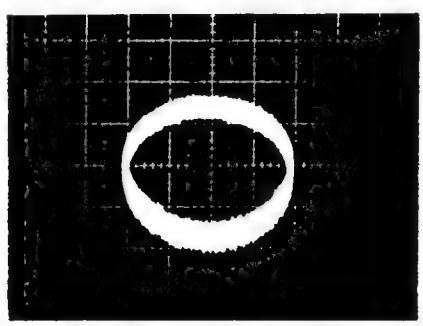


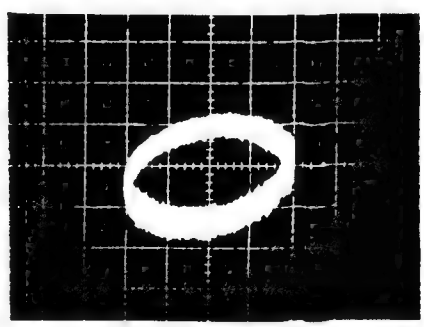
Fig.10-14



Gain overcompensated
Photo 10-13



Gain optimal
Photo 10-14



Gain undercompensated
Photo 10-15

Step No.	Oscilloscope Setting V	Oscilloscope Setting H	Test Points	Adjusting Points	Check items/ Adjustment specifications	Adjustment procedure
10	VCO free-run adjustment					
			TP2 Pin 2	VR8 (VCO.ADJ)	4.375 ±0.025MHz	● Put unit in the test mode (see page 36). ● Short the ASY and GND jumper with a screwdriver or similar tool (see Fig. 10-15). ● Connect a frequency counter capable of measuring frequencies of 10MHz and above to TP2 pin 2. ● Adjust VR8 (VCO adjust) so that the frequency counter reading becomes 4.375 ± 0.025MHz.
11	Method for confirming focus error					
			TP1 Pin 6 (FCS. ERR)			● Put unit in the test mode (see page 36). ● Ground TP1 pin 5 FCS.IN (focus in) to GND. ● Observe the waveform output by TP1 pin 6 FCS.ERR (focus error) when the TRACK FWD (▷▷I) key is pressed.

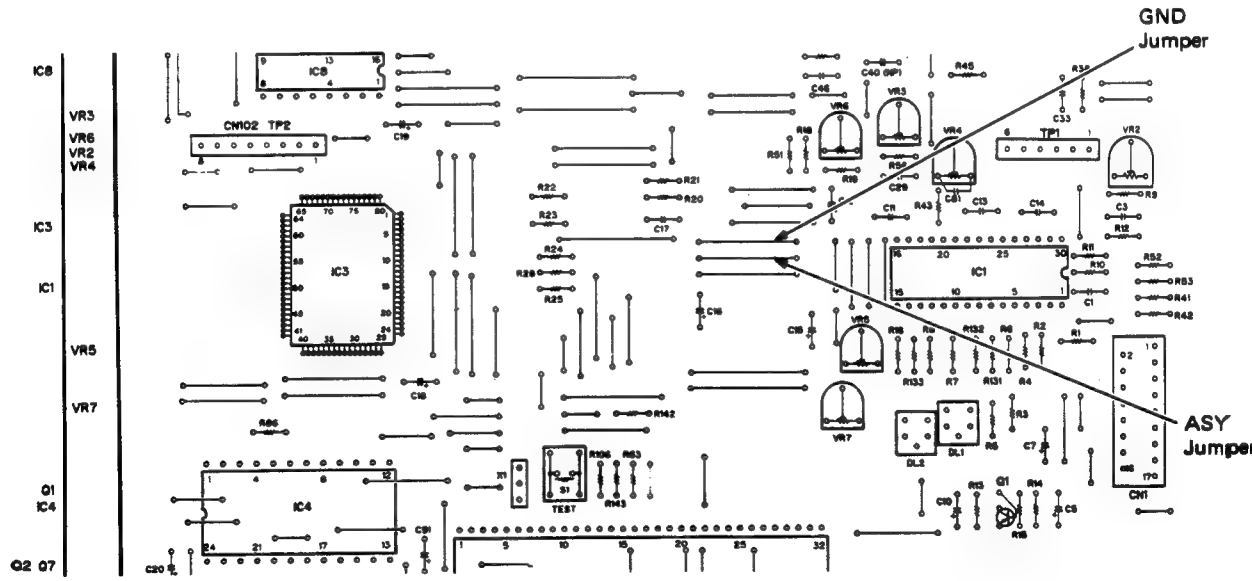
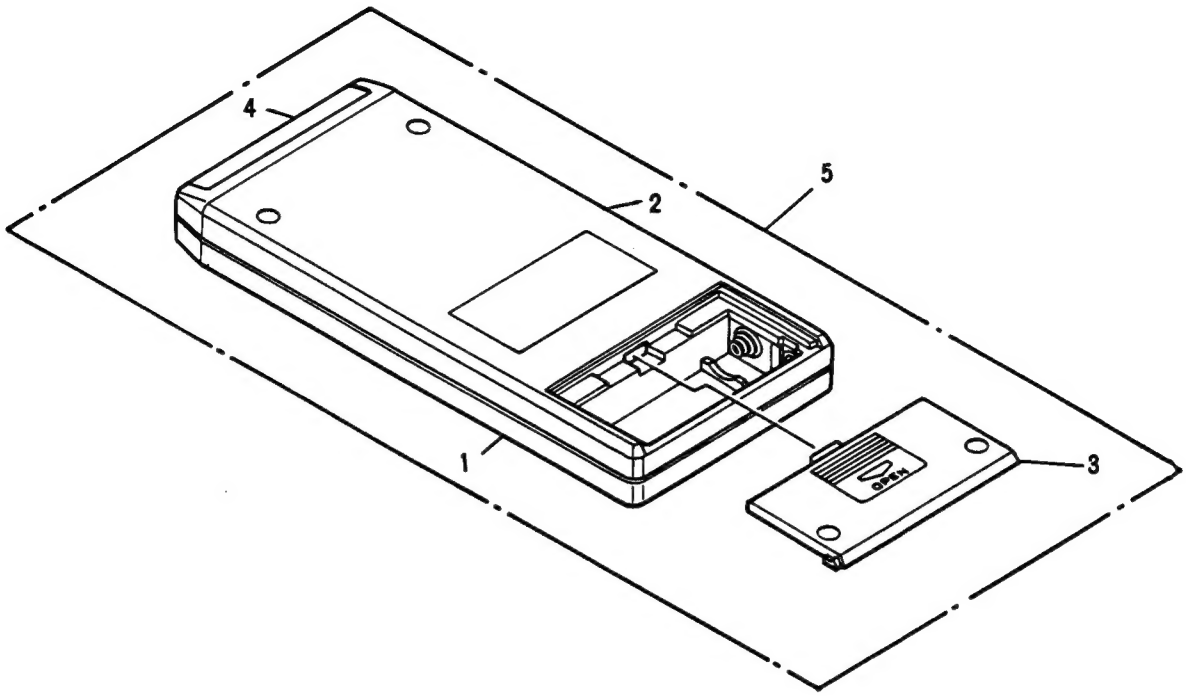


Fig. 10-15 ASY and GND Jumper position

11. REMOTE CONTROL UNIT



NOTES:

- *Parts without part number cannot be supplied.*
- *The ⚠ mark found on some component parts indicates the importance of the safety factor of the part. Therefore, when replacing, be sure to use parts of identical designation.*
- *For your parts Stock Control, the fast moving items are indicated with the marks ★★ and ★.*
  ★★ GENERALLY MOVES FASTER THAN ★
  This classification shall be adjusted by each distributor because it depends on model number, temperature, humidity, etc.
- *Parts marked by "◉" are not always kept in stock. Their delivery time may be longer than usual or they may be unavailable.*

Parts List of Remote control

Mark	No.	Part No.	Description
	1.	PNW1151	Case (T)
	2.	PNW1152	Case (B)
	3.	PNW1153	Cover
	4.	PAM1071	Filter
	5.	PWW1006	Remote control unit

12. FOR KC, HEM, HB AND SD TYPES

12.1 CONTRAST OF MISCELLANEOUS PARTS

NOTES:

- *Parts without part number cannot be supplied.*
- *The ⚠ mark found on some component parts indicates the importance of the safety factor of the part. Therefore, when replacing, be sure to use parts of identical designation.*
- *For your parts Stock Control, the fast moving items are indicated with the marks ★★ and ★.*
  ★★ GENERALLY MOVES FASTER THAN ★
  This classification shall be adjusted by each distributor because it depends on model number, temperature, humidity, etc.
- *Parts marked by "◉" are not always kept in stock. Their delivery time may be longer than usual or they may be unavailable.*

The PD-7050/KC, HEM, HB, SD, and PD-7050-S/HEM types are the same as the PD-7050/KU type with the exception of the following sections.

Mark	Symbol & Description	Part No.						Remarks
		PD-7050/KU	PD-7050/KC	PD-7050/SD	PD-7050/HB	PD-7050/HEM	PD-7050-S/HEM	
⚠ ◉	Main board assembly	PWZ1138	PWZ1138	PWZ1139	PWZ1139	PWZ1139	PWZ1139	*
⚠	Strain relief	CM-22C	CM-22C	CM-22B	CM-22B	CM-22B	CM-22B	
⚠	AC power cord	PDG1002	PDG1002	PDG1013	PDG1004	PDG1003	PDG1003	
⚠ ★★	Line voltage selector	. . .	. . .	PSB1002	. . .	. . .	. . .	
⚠ ★	Power transformer	PTT1008	PTT1008	PTT1014	PTT1011	PTT1011	PTT1011	
	Operating instructions (English)	PRB1015	. . .	PRB1015	PRB1015	. . .	. . .	
	Operating instructions (English/French)	. . .	PRE1014	. . .	. . .	PRE1014	PRE1014	
	Operating instructions (German/Italian)	. . .	. . .	. . .	. . .	PRF1003	PRF1003	
	Packing case	PHG1054	PHG1055	PHG1055	PHG1055	PHG1055	PHG1068	
	Phone knob	PAC-266	PAC-266	PAC-266	PAC-266	PAC-266	PAC-265	
	Power button	PAC1058	PAC1058	PAC1058	PAC1058	PAC1058	PAC1069	
	Track button	PAC1059	PAC1059	PAC1059	PAC1059	PAC1059	PAC1070	
	Display button	PAC1060	PAC1060	PAC1060	PAC1060	PAC1060	PAC1071	
	Select button (A)	PAC1062	PAC1062	PAC1062	PAC1062	PAC1062	PAC1073	
	Select button (B)	PAC1063	PAC1063	PAC1063	PAC1063	PAC1063	PAC1074	
	Front panel	PAN1025	PAN1025	PAN1025	PAN1025	PAN1025	PAN1027	
	Bonnet	PNA1107	PNA1107	PNA1107	PNA1107	PNA1107	PNA1108	
	Function panel (A)	PNW1074	PNW1074	PNW1074	PNW1074	PNW1074	PNW1090	
	Name plate A	PNW1071	PNW1071	PNW1071	PNW1071	PNW1071	PNW1094	
	Play button	PAC1061	PAC1061	PAC1061	PAC1061	PAC1061	PAC1072	

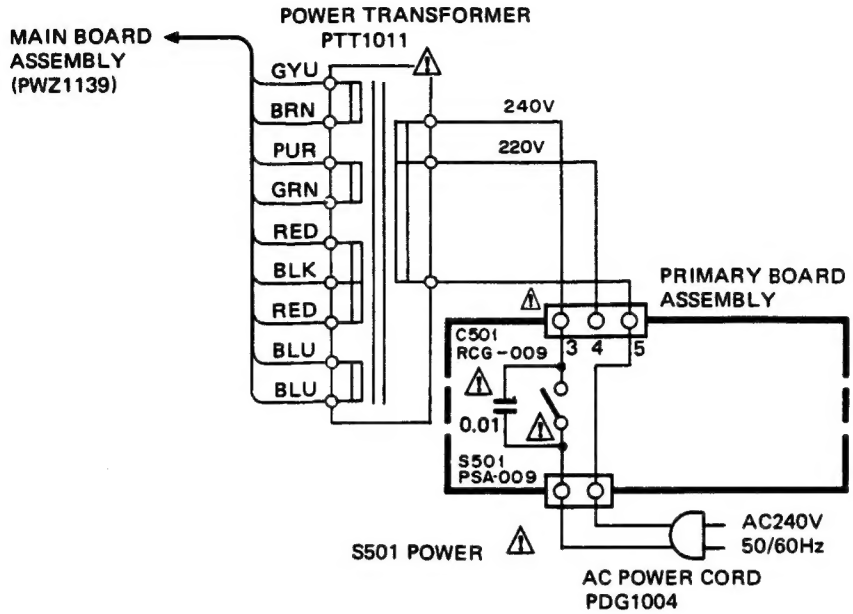
*MAIN BOARD ASSEMBLY (PWZ1139)

The Main board assembly (PWZ1139) except for KU and KC types are the same as the Main board assembly (PWZ1138) for KU and KC types with the exception of the following sections.

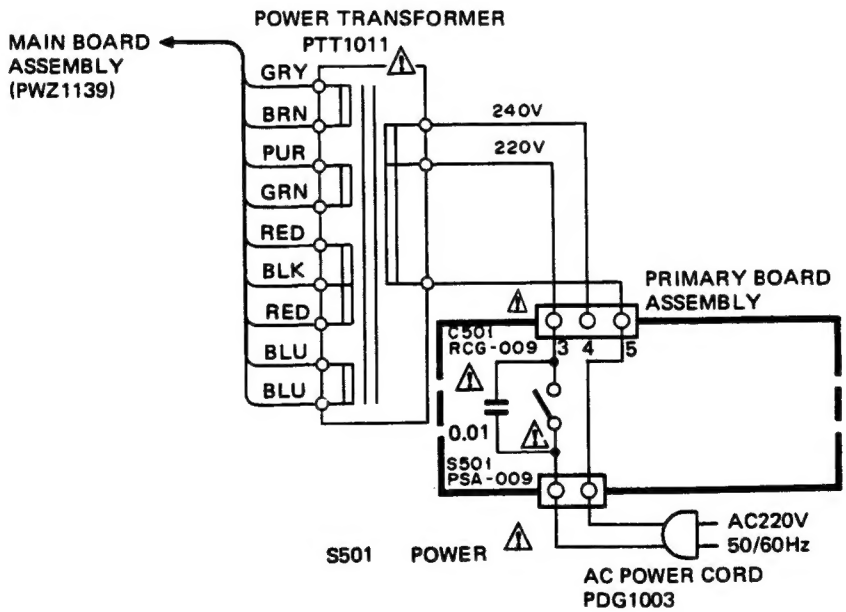
Mark	Symbol & Description	Part No.		Remarks
		PWZ1138 for KU and KC types	PWZ1139 except for KU and KC types	
★★	IC32	. . . . .	ICP-F10	
★	D1–D4	S5688B	. . . . .	Mounted for the same location
★	D25	. . . . .	2W02	on P.C. Board assembly

12.2 SCHEMATIC DIAGRAM

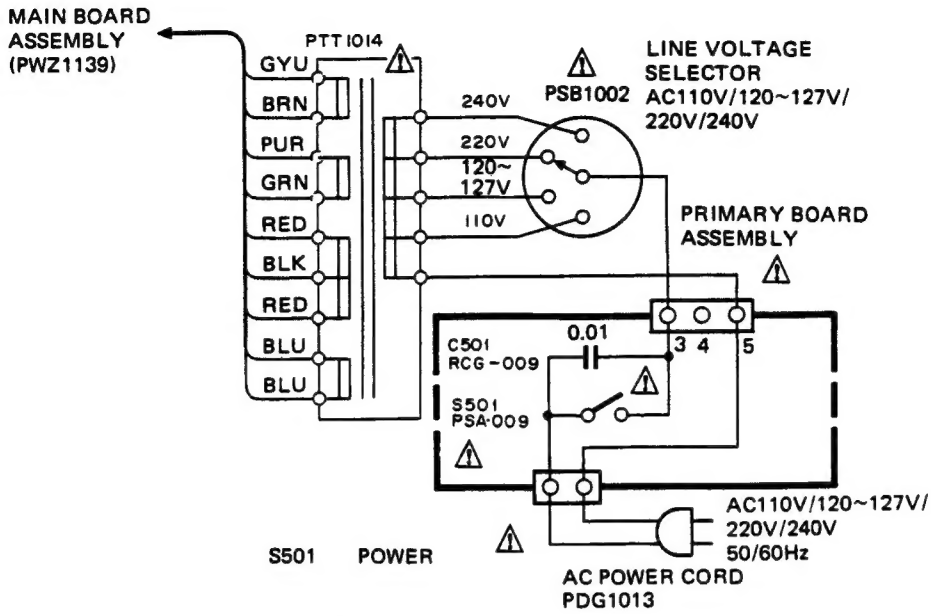
- **For HB type**



- **For HEM type**



- **For SD type**



Underlined indicates the switch position.